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OF THE

DEPARTMENT OF AGRICULTURE

BOMBAY PRESIDENCY

FOR THE YEAR 1921-22

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ANNUAL REPORT OF THE DEPARTMENT OF AGRICULTURE, BOMBAY PRESIDENCY, 1921-22.

The Agricultural Department of the Bombay Presidency has now been in existence thirty-nine years, having been formed as a result of recommendations contained in the report of the famine commission which sat after the great famine of 1877. Its primary functions in the early years were statistical, but gradually its purposes have widened, and now it is recognised as being an organisation to ascertain, by experimental investigation and research, the methods by which the produce of agriculture can economically be increased in quantity and improved in quality, and then to get these methods introduced into practice. The ultimate test of its value is the extent to which the value of agricultural production has been increased as a result of materials and methods which it has recommended.

2. The actual lines on which the work of the Agricultural Department is now being carried on may be divided as follows :—

I. Research and Investigation.
II. Demonstration and Propaganda.
III. Services undertaken for the Public.
IV. Agricultural Education.
V. Administration and Finance.

I.—Research and Investigation.

3. *The Improvement of Crops by Selection and Breeding.*—Judged by the experience gained in the last few years, there is no more productive line of work towards the increase in the value of agricultural produce than the development of types of the main crops which will either give better crops or higher quality in the produce. The production of such types by selection or by actual breeding, more suited either by increased vigour, great drought resistance, immunity to disease and the like is a matter of time, and demands very thorough and precise work, but in most cases where work has been begun on proper lines, it seems certain that within five years improved types which are a really substantial advance on the types usually cultivated may be expected to be available on a small scale. So far the work on the lines now recognised as satisfactory has been limited to three or four crops but in each of these distinct advance can be reported in the year.

Cotton.—The case of cotton, to which the agricultural department has always given special attention, naturally stands first, for in this crop there are special officers employed in the four chief cotton tracts (North Gujarat, South Gujarat, Khandesh and the Karnatak) for the definite purpose of producing new and improved strains of cotton. The work in South Gujarat and in the Karnatak has been described in previous reports and in these two cases improved varieties are in cultivation in an area counted by lakhs of acres. To maintain the purity of these improved types means continuous re-selection each year and growth under control for several generations. In the Karnatak, in addition to the work previously reported, new types of Kumpta cotton have been developed by crossing at Dharwar and are now fixed, which have the staple of the best Kumpta, have a ginning percentage of 33 instead of the local normal of 26-27, and have unlike all existing strains of Kumpta cotton a pure white colour. The new types need further testing with regard to their yielding capacity, but they are sufficiently promising for us to be sanguine of their introduction into cultivation in a year or two. Several other even more promising types are in an earlier stage of development at Dharwar.

At Surat, similar progress is being made. One at least of the improved pure strains of Navsari cotton has proved capable of giving good results at least as far North as the Nerbudda river and is now being grown on a large scale. The work of continual re-selection is being regularly continued at Surat, and crossing has been undertaken, which gives promise of giving, here, a cotton of equal staple to

Navsari, with a much higher ginning percentage. In Northern Gujarat a series of accidents has hindered the rapid development of cotton breeding work, but it is now on right lines and is developing.

In Khandesh and other areas where Khandesh types of cotton are grown, work is in some ways not so advanced. A number of years ago a high yielding, high ginning type of cotton (N. R.) was obtained by selection, suitable for this region, and has been widely spread by the people. It is now grown in a relatively pure form over 45,000 acres in the Khandesh District, and it has also spread largely in Sholapur. This type is not, however, satisfactory as, in spite of its other good characters, it is a short staple cotton. Hence, new work has been undertaken, and is in progress at Dhulia, by which re-selection is being made from other existing types, and also from the produce of a cross between *Bani* and Comilla cotton made some years ago. As a result we expect shortly to obtain a type with the yielding and ginning qualities of " N. R." cotton, but with much better staple. Distinct progress has been made, and within two or three years types should be available for distribution on a small scale.

In Sind for the first time, we have now a fully trained man, Mr. K. I. Thadani, who can devote his principal attention to the breeding of improved cotton. But much work has nevertheless been done. The principal directions of activity have been two. On the one hand a strain of Sind *deshi* cotton known as " 27 WN " has been developed and yields 16½ per cent. more lint from the same amount of land than the type usually grown. Seed of this is now available for from two to three thousand acres and this should mean twenty-five to thirty thousand acres next year. On the other hand after experiment with many types of American cotton, the Punjab selection known as " F-4 " was distributed on 3,000 acres in 1921. The quality of the cotton produced was not so high as expected, and the cultivators did not get the premium they expected. The area under this seed, has, however, risen to 7,000 acres in 1922, and it is the opinion of the Deputy Director of Agriculture in Sind (Mr. Main) that this type must form the basis for a really satisfactory American cotton for Sind.

Rice.—The improvement of the types of rice grown is of peculiar difficulty as this crop is intensely localised, and the area for which a new type is suitable is often very small. But in the North Konkan (Thana and Kolaba) progress is being made. The new strain of *Kolamba* rice developed at Karjat is justifying the confidence expressed in my report last year. Thus, on cultivators' fields it yielded 29 per cent. above the local variety. Next year we shall have seed of this and one or two other strains available for two or three thousand acres. Vigorous work on the same lines has been undertaken in the Larkana District in Sind, but it will be two or three years before pure improved types of rice are ready for distribution there.

Wheat.—The improvement of the types of wheat grown in the Bombay Presidency is a matter of great importance. In Sind it has been taken up by using the results of other workers in North India and so introducing into Sind such of their selections as suit the conditions. Two of these known respectively as " Pusa 12 " and " Punjab 11 " have proved particularly suitable and their extension is only a matter of time. " Pusa 12 " is a particularly early wheat, while " Punjab 11 " is resistant to the attacks of birds. Both yield well and we are able annually to furnish from our own farm seed for one thousand acres. The increasing of this amount by means of regular seed growers or co-operative seed societies is now in process of organisation.

Similarly the variety known as " Pusa 4 " has been a great success in North Gujarat and is spreading fast in the Panch Mahals. This year has seen a considerable extension and promise of more, for the yield is good and the quality of the grain is so superior to the local *Wajia* at Dohad that sometimes no less than fifty per cent. more value per acre is obtained for it.

In the other areas of the Presidency proper, the North Indian selections have not been a success, and we have had to fall back on the development of our own. A number of types of seed have been obtained which show great promise of increased yield under Deccan conditions, but it will be another year before we can speak with any confidence with regard to them.

Jowar.—Work on the improvement of the *Jowar* crop by seed selection is only just beginning, but a good start has been made at Dharwar, and there is

already promise that the application of strict plant selection methods will lead to considerable improvement in yield for that area.

Bajri.—The work commenced last year on the improvement of the *Bajri* crop has been continued. It is in the very capable hands of Dr. Burns, but the production and maintenance of improved strains of this crop is of peculiar difficulty. Work is so far not much more than a reconaissance, but the object in view is the development of types with high drought resistance and high yield.

Sugarcane.—The long continued work at Manjri Farm on the testing of new varieties of cane for special purposes is now bearing fruit. One of the selections tested there (*Manjav*) is proving itself of great value for waterlogged areas under the canals in the Ahmednagar District. Another (Red Mauritius) is rapidly ousting the local variety in Kanara, on account of the facility with which it gives high yields in the ratoon crop. In South Surat, several of the Manjri types are in keen demand to replace the local *Malbari* cane as they give higher yields and are less susceptible to red rot.

Tobacco.—Really systematic study with a view to the development and maintenance of the best and most suitable types of tobacco has not hitherto been done, but on the reorganisation of work at Nadiad, using an area of land belonging to the Nadiad Agricultural Association and with its assistance in finance, it has been possible to take up this matter during the year under report.

4. *Increase of yield by Cultural Methods.*—Two decided successes which would seem to have large application have been obtained during the last year. The first of these consists of the application of repeated shallow hoeings to the land during droughts in the Sholapur District. By this means in two successive years at Mohol we have been able to save the cotton crop when all cultivators considered their own a failure and grubbed it up. In the case of *Jowar* similar methods led to a crop about twenty-five per cent. greater than that of surrounding cultivators. The implements used for this purpose are simple, and extensive propaganda is being undertaken for the general adoption of the method.

A still greater success has been attained in three successive years by the adoption of ridge cultivation in the black soil areas round Surat. In this area the limiting factor in the yield of both *Jowar* and cotton appears to be the waterlogging which takes place each year during July when the crops are grown on the flat. By growing the crops on high ridges this is avoided, and the result in 1921-22 in the case of *Jowar* was an increase in yield of 55 to 60 per cent. This is in accordance with results obtained in the previous year, and already there is a decided local demand for the application of the method.

5. *Increase of yield by Artificial Manures.*—The extension of the use of artificial manures in Western India has not on the whole been a great success, but in two cases at least their value may be taken as proved and the last year has seen some considerable increase in their use. The first of these is the gradual replacement of a portion of the fish and oil-cakes used with sugarcane on the Deccan Canals by Sulphate of Ammonia. This, which is now a large Indian product, has furnished a cheaper nitrogenous manure, value for value, than any other in the last year, and its extension is rapid, more particularly in the canal areas of the Ahmednagar District, and in the Satara District and the Kolhapur State. Its value was originally proved at Manjri and the consumption in the Deccan is now between one and two thousand tons per annum, and is increasing fast.

The other decided success is the use of bone meal as a manure for rice in the laterite and light soil areas of the Konkan in Ratnagiri, Belgaum and Kanara. The value has been proved upto the hilt both at Ratnagiri and Kumta, where increase of yield by twenty-five to fifty per cent. has been repeatedly obtained, but the extension of its use is slow. The demand is increasing, and vigorous propaganda is being undertaken to extend its use more rapidly.

6. *Improvement of yield by the checking of Pests and Blights.*—The amount of loss caused annually by the great scourges of our crops reaches many crores of rupees. If we take together the damage by *jowar* smut and the *jowar* borer to our greatest cereal crop, by wilt and the bollworm to cotton, by rust to wheat, by grasshoppers to a variety of crops, by the *katra* caterpillar (*Amsacta moorei*) to almost all cereal crops in Northern Gujarat, by mildew to grapes, by the murda disease of chillies and by many other major and minor plant diseases and pests,

the loss probably amounts to at least twenty-five to thirty per cent. of the actual crop obtained, and their abolition would mean the increase of the crops by this amount. Some of these enemies have been vanquished, and all that is to be done is to bring known and practical methods into general use. Such is the case with the smut of *jowar*, where an expenditure of one anna per acre will banish most forms of smut, and the mildew of grapes. In the latter case the method devised of spraying the vines with Bordeaux Mixture is now very generally adopted. Another case that has entered the category of vanquished enemies during the last year is the *murda* disease of chillies, which is very widely prevalent wherever this crop is grown. It is caused by a mite and can be easily and completely checked by dusting the plants with a mixture of sulphur and lime.

But the dealing with most of these diseases represents a very difficult problem, and though all are, I fully believe, remediable, yet it will take some years before we are in a position to checkmate them. We have commenced work on some of these diseases. Thus in the case of cotton wilt we have begun the attempt to breed a wilt resistant type of cotton at Dharwar. There are, in fact, types of Indian cotton, which are all but absolutely immune to wilt and the idea is to breed into our desirable varieties this particular quality. The work is, however, only just commencing. The study of the *jowar* borer, which itself causes a loss of a crore of rupees in the Bombay Presidency in many years and which is said to make *jowar* growing impossible in many parts of Lower Sind has been taken up at Surat, under a grant from the Sassoon David Trustees and progress is being made. It represents, however, one of the most difficult of our problems and it will at least take several years thoroughly to study it and ascertain the best line of attack.

In Upper Gujarat and especially in the Panch Mahals enormous damage is done annually at the beginning of the rains to all the cereal crops by the *katra* caterpillar (*Amsacta moorei*), and the people of the districts look upon it as their worst enemy, often leading to the complete loss of the crop. This year, following much study of the pest we have undertaken several large scale (50 acres) experiments on the checking of the pest by means of dusting with a mixture of Paris Green and Lime. The result is more than promising. For a cost for materials of slightly over Rs. 2 per acre we have been able completely to stop any loss on this account, and if a similar result is obtained in still larger scale work next year it will be possible to organise the treatment as a very big matter in the area where the damage is greatest.

Other diseases and pests under careful study are several of the diseases of potato, where treatment for the *tambera* disease, the chief hindrance to cultivation of this crop in the *kharif* season is now being recognised and demanded by the people, the wilt disease of onions which has been preventing the extension of this crop in Kanara and has been found to be capable of check by means of using Goa seed, the *katte* disease of cardamoms, which threatens to destroy the cultivation of this crop in Kanara and which is peculiarly obscure has been traced to its source, however, by Mr. D. L. Sahasrabudhe and his experiments have suggested methods of check which are under experiment. One of the most destructive enemies of rice cultivation is the land crab about the habits of which very little is known. It is under careful study at Karjat and practical results cannot fail to be obtained in two or three years.

One of the most widespread pests of all cultivation especially in the tracts near the Western Ghats or near forest areas as well as in the sugarcane area is the wild pig. The depredations of these animals have been so great that during the year under report Government have appointed a Committee with Dewan Bahadur K. R. Godbole, M.L.C., as Chairman and the Director of Agriculture as Secretary to study the position and make recommendations. The report of this Committee will be ready, in all probability, in the early part of 1923. In the meantime experiments are being continued on the prevention of damage by wild pigs by co-operative fencing (where one large scheme has been inaugurated near Dharwar), on the use of poison for their destruction, on the organisation of hunting parties in sugarcane areas and on other methods.

7. There is another method of approaching the question of the improvement of crop yields, namely the close study of a particular crop in all its aspects, with a view to finding out what are the factors which determine yield, and what are the best methods of influencing them. This method has been adopted in the case of

the rice crop at the Karjat station, and the result has been to clear up a large number of points and to enable us to concentrate attention on the essential points in the increase of crop production in this case. Mr. K. V. Joshi, in whose hands this work has been placed, has found that apart from an improved strain of plant (which, as recorded in paragraph 3 we are securing) the only line of action for increasing the yield is by manuring, other proposed methods having all led to negative results. The actual kind, extent and time of the manuring which can give the most economical result is now being investigated.

A similar method of study has been adopted in the case of the potato crop, more particularly as it is grown in the northern talukas of the Poona district, and has led to a fairly complete understanding of the difficulties of the cultivators and the methods of dealing with them. I have already referred to the way in which the *tambera* disease has been met, and how, as a result the growing of potatoes in the *kharif* season on a much larger scale has become possible. But there are a number of other diseases and pests attacking the plants and the stored tubers which are so inter-related that the methods of dealing with them have only been elucidated when they were considered all together, as a whole. The same study has led to the application of artificial manures to this crop, and to a local demand for these which now shows a tendency to increase and to organise itself.

8. *Improvement in Cattle.*—A report on research and investigation would be incomplete if it did not refer to the work which is being done on the improvement of cattle and which is concentrated at the two farms at Chharodi in North Gujarat, and Bankapur in the Dharwar District, as well as at the Surat farm. The object here is definitely to improve two breeds (namely the Kankrej type of Gujarat and the Amrit Mahal of South India) and make them more suitable for the regions in the Bombay Presidency for which they are adapted. These investigations have revealed a milking capacity in the Kankrej breed which was previously unsuspected, and we have now cows of this breed which in milk production stand well with the best Indian milking breeds. Their male progeny are, of course, of enormous value for spreading the milking strain, though this value is being only slowly appreciated. But this appreciation will come in time, by efficient demonstration and propaganda.

Government have, during the year under report, appointed a committee to consider the question of cattle improvement and fodder storage in all its aspects, whose chairman is Rao Bahadur G. K. Chitale, M.L.C., and whose Secretary is the Deputy Director of Agriculture, for Animal Breeding. Its report is not yet received, but is expected in January 1923.

II.—Demonstration and Propaganda.

9. As I remarked in my report last year, the one ultimate test of the success of an Agricultural Department and of the whole of its research, educational as well as its other activities, is whether the recommendations made are actually brought into practice, and have resulted in increase in the quantity or improvement in the quality of the material produced. As a rule, this will also naturally result in increasing the profit to the producers, that is to say, to the cultivators. But I want again to lay definitely down as the one purpose of our existence as an Agricultural Department, the increase in the quantity or the improvement of the quality of agricultural produce.

10. The efforts to bring this about have led, during the year under report, to a good many changes in organisation, to a definitely closer co-operation between the Agricultural and the Co-operative Departments, to the institutions of Divisional Boards which control the propaganda activities of both Departments, and to the definite adoption of a system of local development associations, subsidised by Government, for the carrying on of agricultural propaganda in areas which desire it. I will deal with these in turn.

11. The general desire that the Co-operative Department, so far as non-credit rural co-operation is concerned, should work in the closest touch with the Agricultural Department was voiced at the Provincial Board of Agriculture, in September 1921, and the result of the discussions there led to the issue of a Press Note dated October 21st, 1921, under which it was provided that six Divisional Boards respectively for Sind, Gujarat, Khandesh and Nasik, the Deccan, the Southern Maratha Country and the Konkan should be established, each consisting of two officials and four non-officials for the control of propaganda for agriculture

and for non-credit rural co-operation in the area assigned to them. Their actual duties were defined as follows :—" The Boards will control the portions of the Government grant for loans to Agricultural Societies now in charge of the Registrar of Co-operative Societies, and of the discretionary grants for propaganda purposes now in the charge of the Director of Agriculture, as distributed by these two officers among the divisions. The Boards will also advise on the application of the policy of the two Departments within the division, and will have power to call for any information and data required from the Assistant Registrar or Assistant Registrars and the Deputy Director of Agriculture ". The proceedings of these Boards were to be considered by the Director of Agriculture and the Registrar sitting jointly, and orders also issued by them jointly.

The Boards thus contemplated have now all been constituted and have all met with the exception of those for Sind and the Konkan. They promise in some cases to take a very effective interest in the development of both agricultural and co-operative propaganda and I have specially to call attention to the keenness with which the new obligations have been assumed in the Southern Maratha Country and in Gujarat. During the next year, however, there will be a fair chance to see how far the desired end is attained, and on the one hand agricultural propaganda more effectively carried out and, on the other, more satisfactory agricultural organisations for bringing improvements into practice secured.

12. But the mere direction of a number of official propaganda officers by a Divisional Board, however effectively organised, will not be enough, and it was felt that the development of local initiative in small areas by cultivators themselves was essential to the rapid spread of agricultural improvements and to the organisation of their use. This meant the establishment of local agricultural associations of some sort. Now the success of such Associations in the past has been very varying, and it was felt that it was necessary to provide for (1) a limited area for each association, where the interests were likely to be fairly similar. This was provided by the taluka ; (2) a definite interest by Government in the success of each association. This was provided by the offer of a subsidy of any amount upto Rs. 1,000 per annum, (but not exceeding half the total expenditure), to each association, provided it satisfied certain conditions ; (3) a condition that each such association should employ a paid demonstrator approved by the Agricultural Department for its work ; and (4) a condition, likewise, that the annual programme should be approved and the subsidy recommended by the Divisional Board.

Under this scheme three associations have been formed before the end of June 1922. These are in the Madha taluka of the Sholapur District, the Pachora Taluka of East Khandesh, and the Chorasi Taluka of the Surat District. A good deal of local interest has been aroused in each case, the local co-operative bodies as well as others are co-operating financially, and the organisation of such bodies in a good many talukas is likely at an early date. The number of associations under this scheme will probably reach between twelve and sixteen in the year in which I am writing.

Associations organised under this scheme will, in all probability, gradually replace those on a pure non-official basis which have previously existed. But we can never forget the good work which some of these have done in the past in various parts of the Bombay Presidency. In Khandesh they have been a very important feature of the organisation of agricultural improvement, and they will continue to exist in any case. Certain associations have been, and still are bearing at least the financial responsibility of vernacular agricultural magazine. The Deccan Agricultural Association has continued to bring out the monthly *Shetki and Shetkari* in Marathi. The Dharwar Agricultural Association has published the monthly *Vakkaligaru Vakkalitanama* in Kanarese, and the Broach Agricultural and Industrial Association has continued quarterly the "Gujarat Agricultural and Industrial Quarterly " in Gujarat.

13. So far as the materials of propaganda are concerned these have been almost all referred to in the section of this report dealing with research and investigation. But I cannot help referring to the continued success which has been achieved in the case of cotton seed. In Surat the cotton seed originating from the Surat farm has come to enjoy a tremendous popularity. Eighteen thousand acres of cotton grown directly or indirectly from that seed have been supervised by the special staff of

the Agricultural Department in 1921-22, and it is estimated that over 250,000 acres are growing improved cotton south of the Nerbudda river. Further the percentage of *Goghari* cotton in the material grown by the people has been reduced to a very small fraction of what it was in 1919.

It is more difficult to gauge the spread of the new types of cotton seed provided by the Agricultural Department in the Southern Maratha Country, as the distribution, beyond the earlier stages, is in the hands of co-operative bodies. The Deputy Director of Agriculture, however, estimated that, of the improved cottons produced on the Dharwar farm, enough seed for about 70,000 acres was sold. Of this seed for over 13,000 acres went out definitely, with the guarantee of the Agricultural Department. A crop of these selected cottons amounting to nearly 22,000 *dokras* was handled by co-operative societies, by the Dharwar Agricultural Association, and by the Agricultural Department, and the increased prices realised on this alone represent over one and a half lakhs of rupees in the last year. The cotton seed used for distribution in Khandesh (N.R. cotton) continues to be in great demand as a high yielding cotton of high ginning percentage. We are, however, not by any means satisfied with it and are looking forward to the time when we shall have types in hand giving similar yields and ginning percentage, but considerably improved staple.

14. I must refer to the accounts by the Deputy Director, however, for a detailed account of the propaganda work undertaken. I need hardly say, however, that the closer co-operation with the Co-operative Department has given considerable stimulus to it, while a still more active and energetic spirit is abroad among many of our district workers. A special class for such district workers was held in Poona in April 1922, which was organised by Mr. K. M. Pawar, Inspector of Agricultural Schools, and resulted in much inspiration to the men who attended it, in the very difficult work entrusted to them.

15. The propaganda of the Agricultural Department is done in part both directly and indirectly by means of publications, of which the following have been prepared and issued, (or arranged for) during the year under report. Some of those announced in last year's and the previous year's report have also been issued in the present year.

Station Reports and Bulletins.

(1) Triennial Report of the Experimental Work of the Sukkur Agricultural Station for the years 1918-19 to 1920-21.

(2) Triennial Report of the Agricultural Station, Larkana, for the years 1918-19 to 1920-21.

(3) Triennial Report of the Experimental Work of the Mirpurkhas Agricultural Station for the years 1918-19 to 1920-21.

(4) Triennial Report of the Experimental Work of the Landhi farm for the years 1918-19 to 1920-21.

(5) Report of the Experimental work of the Ratnagiri Agricultural Station for the years 1916-17 to 1919-20.

(6) Report of the Experimental work of the Alibag Agricultural Station for the years 1916-17 to 1919-20.

(7) Summary of the work done on the Jalgaon Farm (in Marathi).

Leaflets (with Vernacular versions).

(1) No. 5 of 1921.—Tobacco—A profitable new crop for Kanara District.

(2) No. 1 of 1922.—Cultivation of Hill Paddy of Varkas Lands in the North Konkan.

(3) No. 2 of 1922.—Green Manuring of Nagli with San.

(4) No. 3 of 1922.—Cultivation of Sugarcane on waterlogged lands in the Deccan.

(5) No. 4 of 1922.—On sugarcane cultivation.

III.—Services undertaken for the Public.

16. Apart from the direct propaganda activities of the Agricultural Department, there are a number of services which it undertakes, which in most other countries are undertaken by private agency, and which in future years may be undertaken here by such agency. Some of these services may be here referred to.

17. *Seed Supply.*—The first of them is the organisation of the supply of pure seed. The present organisation of the supply of pure cotton seed is an example. The original seed is produced by our breeders, and new freshly selected pure seed is provided by them in limited quantities every year. The amount is multiplied on our farms whether in Sind (Mirpurkhas), Khandesh (Jalgaon), the Southern Maratha Country (Dharwar and Gadag), and Gujarat (Surat and Broach), until there is enough to sow an area say of from five hundred to two thousand acres as the case may be. This is then given out to cultivators or groups of cultivators to grow under the supervision of the department, and the seed from the produce is either purchased by the department for further distribution at approximately cost price, or by co-operative or other agency under arrangements made with us. This means a large organisation, but until competent private or co-operative agency takes the matter off our hands it must continue.

I have described what is done in the case of cotton, but the method is analogous in other cases, and more than this, we are often the only buying agent available for obtaining seed from one district for transfer to another. Akola *bajri* and Parner wheat are examples. Another analogous service has been the supply of nursery plants and trees from the Ganeshkhind Gardens.

18. *Implement Depots.*—Another need, which was great a few years ago, but which is gradually being transferred to co-operative, private and other agency, is the establishment of depots for the sale and hire of implements, notably iron ploughs. As private and co-operative agency develops, they are gradually being closed, and a number have been transferred, notably a large depot in Belgaum, during the last year.

19. *Water-finding and Boring.*—The demand for the services of the Mansfield water-finder in the trap area, to locate underground supplies of water and hence to find suitable sites for digging wells has continued. No less than 174 sites were tested during the year, and the necessity of such testing is shown by the fact that the indications were only positive in 44 cases. Almost all these tests were made in the trap area, for which alone the machine appears to give satisfactory indications.

The second line of work is that of shallow boring. All the boring machines belonging to the Agricultural Department have been in use and a full tabulated statement of the results has been shown in the Agricultural Engineer's report, which forms an appendix to the present report. The results may be summarised as follows :—

	Number of Bores.	Number successful.	Number unsuccessful or abandoned.	Number incomplete.	Per cent. successful.
Northern Division	58	42	10	6	80·8
Central Division	35	15	8	10	65·2
Southern Division	35	20	13	1	60·6
Sind	3	1	1	1	50·0

The value of shallow boring for agricultural purposes thus differs widely in the different parts of the Bombay Presidency, and this has to determine the distribution of the machines belonging to the Agricultural Department. But the work is valued intensely ; there are usually ten times as many applications for the machines available as can be filled in any year, and a successful result means such an increase in the certainty of obtaining a crop that boring seems a very valuable service not only to the cultivator in question, but to the country at large. The work done has by Government orders during the year been placed on what is much more nearly a paying basis than hitherto, especially in the areas like the Thana and Kaira districts, where borings can be made with a great probability of success.

20. *Fodder Storage.*—The storage of fodder, whether *jowar kadbi* or grass on a large scale and in some cases in a portable form is a new thing in this country, but has always appeared to be a profitable as well as a useful operation in a country affected with fodder famine, and hence with large changes in price from year to year. The principal work in this direction this year has been the storage of shredded *kadbi* in a baled condition at Kopergaon in the Ahmednagar district, and

the result has been that in each of the recent famines large quantities of such *kadbi* have been available. No less than 3½ lakhs of pounds of such first class fodder was supplied from the stores there in the 1920-21 famine in the Ahmednagar District. In 1921-22 nearly 2 lakhs of pounds was placed in storage at Kopergaon.

A scheme for the storage of large quantities of *jowar kadbi* fodder purchased and shredded at the very cheap centre of Karajgi in the Dharwar district has been proceeded with during the year, and the machinery will be in full working order at the beginning of December 1922, so that storage can be made in the current year.

21. *Supply of Premium Bulls.*—The supply of breeding bulls of first class type is one of the present duties of the Agricultural Department and is under the control of the Deputy Director of Agriculture for Animal Breeding. In the Gujarat tract these are derived from our own herd of *Kankrej* animals at Chharodi and in Dharwar we have now a similar supply of the Mysore breed from the newly established herd at Bankapur. In other tracts we have, as yet, to purchase the best animals that our experts can find for the purpose. The whole question of the future supply of first class bulls to cultivators is under the consideration of the Cattle Committee appointed by Government and previously referred to. The demand for breeding bulls is practically large and insistent from the South of the Bombay Presidency.

IV.—Agricultural Education.

22. The Agricultural College at Poona continues to be very popular. There has been a rapid increase in the number of students since 1919, which has reached a climax in 1921-22, when there were 205 students at the College. This is really more than the equipment and staff of the College can cope with, and the number has been reduced in 1922 to 194 and will quite probably decrease in the next two or three years. There has been a large influx of students from other parts of India, but no properly qualified student from the Bombay Presidency has been refused admission. The present rule is to admit men from outside the Bombay Presidency only if there are vacancies left after all Bombay demands are met. The short course has not been started this year, as it evidently needed reorganisation, but the matter will be fully considered before another College year opened.

23. During the year Mr. J. B. Knight, who has been Professor of Agriculture for many years, and acting Principal, since 1918, went on long leave and Dr. Burns took his place as acting Principal. Mr. B. S. Patel has become Professor of Agriculture in Mr. Knight's place. I cannot allow these changes to pass without a word of appreciation for the hard, laborious and energetic work put in by Mr. Knight in the working of the College for many years, in the establishment of the courses, and in making the College the most popular Agricultural College in India. Of other members of the College staff, Mr. G. S. Kulkarni, Assistant Professor of Mycology, was absent in Europe for study for the greater part of the year.

24. The results of the University Examinations in Agriculture were on the whole satisfactory. Out of forty-seven candidates for the degree in agriculture forty-four passed of whom three were in the first class. This is an unusually large proportion of first class candidates in this examination. In the intermediate examination, only fifty-seven passed out of eighty-two candidates.

25. The following Agricultural Schools are now working and the number of students at each school is shown below :—

Marathi	..	Loni	50
		Jambul	26
Kanarese	..	Devi Hosur	22
Gujarati	..	Godhra	28
Sind	..	Sukkur	8

The first four schools named are established successes, and though there are differences of opinion as to how they should be carried on to get the best advantage from them, yet they are popular and satisfactory. The most doubtful is the case of Jambul in the Konkan and here the future of the school is under very serious consideration. The Sind school is obviously unsatisfactory and does not meet the need in Sind. The policy to follow there is under serious consideration. In

the year, the school at Alibag was closed as it was felt that Jambul could well serve the boys who might otherwise go to Alibag.

On the other hand, a proposal is before Government for the establishment of an agricultural school at Dhulia and it is probable that this will be arranged for in the very near future.

26. A scheme has been adopted during the year under report for the experimental organisation of a number (not exceeding twenty) of primary schools with a definite rural outlook and teaching with a definitely agricultural complexion. The teachers for this scheme in the Marathi areas are being trained at the Loni School.

V.—Administration and Finance.

27. The control of the Agricultural Department has been in my hands during the whole of the year under report. Of the other principal officers of the Department, I have already referred to the loss sustained by the departure of Mr. J. B. Knight, acting Principal of the Poona Agricultural College, on long leave in May 1922. Mr. P. C. Patil, Deputy Director of Agriculture, South Central Division, went on study leave for one year and four months from July 1st, 1922, and Rao Saheb M. L. Kulkarni has acted in his place during the whole year. My Personal Assistant, Mr. F. J. Master, unfortunately met with a serious accident in May 1922, which compelled his absence on leave for the remainder of the year under report.

28. The following appointments in the Indian Agricultural Service were made during the year:—

(1) Mr. V. G. Gokhale, L.Ag., who retained his old position as Deputy Director of Agriculture, Konkan.

(2) Mr. E. J. Bruen, who retained his old position as Deputy Director of Agriculture for Animal Breeding.

(3) Mr. G. S. Cheema, who was appointed as Horticulturist to the Government of Bombay.

29. The following appointments in the Bombay Agricultural Service were created and held during the year :—

(1) Mr. Bhimbhai M. Desai, who retained his old position as Deputy Director of Agriculture, Gujarat.

(2) Mr. H. P. Paranjpe, who was appointed as District Horticultural Officer.

(3) Mr. K. I. Thadani, who on return from deputation to America, was appointed Cotton Breeder for Sind.

30. The following further changes were made in the senior staff of the Department during the year :—

(1) Mr. D. H. Tagare, who had acted as Divisional Superintendent of Agriculture, Southern Division, for several years, reverted to his own appointment in February 1922, and was succeeded by Mr. S. S. Salimath. The appointment has now, however, been ordered to be kept vacant from September 1st, 1922, with a view to its early abolition.

(2) The post of the Divisional Superintendent of Agriculture, Central Division, has been ordered to be abolished from September 20th, 1922, and from that date Mr. V. K. Kogekar, who has occupied it, will retire from the service of Government.

(3) Mr. S. S. Godbole, Assistant Professor of Physics and Mathematics at the Poona Agricultural College, retired from the service of Government on an invalid pension from July 30th, 1921.

(4) Mr. G. S. Kulkarni, Assistant Professor of Mycology at the Poona Agricultural College, was sent on deputation to Europe for study at the end of September 1921. His place has been filled very efficiently by Mr. B. N. Vakil.

(5) Mr. G. B. Patwardhan, who was acting as Economic Botanist to Government in the absence of Dr. Burns, went on four months' leave on the latter's return to duty in June 1922. His place as Assistant Professor of Botany has been occupied by Mr. L. B. Kulkarni.

(6) The post of Inspector of Agricultural Schools, which has been worthily occupied by Mr. K. M. Pawar since its institution, has been held in abeyance from June 1st, 1922. Mr. Pawar has since that time acted as Personal Assistant to the Director.

31. During the year the expenditure on the Agricultural Department amounted to Rs. 19,50,254, as against Rs. 16,09,000 in the year before. The increase is accounted for by the continually widening activities of the Department and by the opening up of intensive work in several new directions (horticulture, plant breeding, etc.) receipts amounted to Rs. 2,68,000 as against Rs. 2,45,000 in the previous year. As regards the Personal Legder Account of Rs. 1,50,000 for the financing of seed, manure, implement supply and the like Rs. 1,10,000 was advanced during the year and Rs. 1,05,450 was recovered. The larger portion of this amount was employed in financing the supply of improved cotton seed in the Surat and Broach District.

32. Grants were received from the Sir Sassoon David Trust Fund during the year amounting to Rs. 15,000. These grants were made for the following purposes :—

(1) Rs. 3,000 towards the cost of six vernacular agricultural schools.

(2) Rs. 5,000 for investigations on the improvement of grazing lands.

(3) Rs. 5,000 for studies on the eradication of certain weeds.

(4) Rs. 2,000 for studies on the deterioration of cardamom cultivation.

These grants are of extreme value and have made possible several most important investigations, which otherwise could not have been undertaken.

33. I should like to record my hearty appreciation of the services of most of the members of the Staff of the Agricultural Department. Government have, in them, an able and keen body of men, from whose work more and more rapid progress may be expected in the coming years in the attainment of the objects for which the Agricultural Department was created.

HAROLD H. MANN,
Director of Agriculture.

APPENDIX A.

ANNUAL REPORT OF THE POONA AGRICULTURAL COLLEGE FOR THE YEAR ENDING JUNE 1922.

This is the fourteenth year of the existence of the College. No Bombay students have been excluded in favour of those outside the Presidency. The present rule is to admit men from outside the Presidency only if there are vacancies left after all Bombay demands are met.

STAFF.

Up till May 16th, 1922, Mr. J. B. Knight, M.Sc., Professor of Agriculture, was Principal. When he went on leave Mr. S. L. Ajrekar, B.A., Professor of Plant Pathology, acted as Principal till the arrival of Dr. W. Burns, Economic Botanist, who then took charge of the office on May 31st, 1922.

Mr. B. S. Patel has been appointed acting Professor of Agriculture, and Mr. G. S. Cheema Professor of Horticulture. Mr. G. B. Patwardhan acted as Economic Botanist and Mr. L. B. Kulkarni acted as Assistant Professor of Botany during Dr. Burns' leave.

The present staff for teaching at the College is as follows :—

(1) Professor of Agriculture	B. S. Patel, B.Ag., N.D.D., N. D. A.
(2) Professor of Botany	W. Burns, D. Sc.
(3) Professor of Chemistry	D. L. Sahasrabudhe, M. Ag., M. Sc.
(4) Professor of Plant Pathology	S. L. Ajrekar, B. A. (Bom. and Cantab).
(5) Professor of Horticulture	G. S. Cheema, M. Sc.
(6) Assistant Professor of Agriculture	G. K. Ranade, L. Ag.
(7) Assistant Professor of Botany	L. B. Kulkarni, M. Ag.
(8) Assistant Professor of Chemistry	N. V. Kanitkar, M. Ag., B.Sc.
(9) Assistant Professor of Entomology	R. S. Kasargode, L. Ag.
(10) Assistant Professor of Physics and Mathematics	J. P. Trivedi, L.C.E.
(11) Assistant Professor of Mycology	B. N. Vakil, M.Sc.
(12) Assistant Professor of Dairying	H. G. Baluch, B. Ag.
(13) Lecturer in Agriculture	K. S. Kulkarni, B.Ag.
(14) Lecturer in Dairying	H. M. Desai, B. Ag.
(15) Lecturer in Veterinary Science	B. B. Joshi, G. B. V. C.
(16) Lecturer in Chemistry	V.G.Patwardhan,B.Ag.,B.Sc.
(17) Lecturer in Entomology	V. G. Deshpande, B. Ag.
(18) Lecturer in Physics and Mathematics ..	A. A. Vasavada, B. Ag.
(19) Demonstrator in Agriculture (Senior) ..	T. N. Chaugule, B. Ag.
(20) Demonstrator in Agriculture (Junior) ..	B. P. Deshapande, B. Ag.
(21) Demonstrator in Botany	T. R. Khadilkar, B. Ag.
(22) Demonstrator in Agriculture in chemistry ..	B. H. Patil, B.Ag.
(23) Demonstrator in Horticulture	S. R. Gandhi, B. Ag.
(24) Demonstrator in Dairying (Senior) ..	N. B. Patwardhan, B. Ag.
(25) Demonstrator in Dairying (Junior)	M. D. Wad, B. Ag.
(26) Demonstrator in Veterinary Science ..	S. N. Nadgir, G. B. V.C.

Messrs. L. B. Kulkarni, N. V. Kanitkar and J. P. Trivedi were on leave during the vacation. Their absence at this time did not interfere with the College work.

OPTIONALS.

The Graduating class elected optionals as follows :—

(*a*) Agricultural Economics, Land Development and Intensive Farming...	28
(*b*) Advanced Botany	5
(*c*) Advanced Chemistry	5
(*d*) Stock Breeding, Feeding and Management including Dairying ..	7
(*e*) Advanced Agricultural Entomology	2

EXAMINATIONS.

Of forty-seven candidates who sat for the B. Ag. Examination 44 passed, out of which three came in first class.

Eighty-two students were sent up for the I. Ag. Examination. Eight of these passed with first class marks and 49 with second class marks.

At the College Examination for the Diploma four candidates were granted the Diploma.

STUDENTS.

The position on June 30th, 1922, was as follows :—

Number of men admitted			97
Of these the following are to be deducted,			
Failed I. Ag.'s of last year who did not return	7		
Men who joined and left	1		
Men who were admitted and did not come	18		
Total ..			26
Total of new men ..			71

Of these four were, on account of their qualifications, transferred to the second year. The strength of the years therefore are as shown in the table below :—

There are in addition, five special students admitted for short periods of training.

THE SHORT COURSE was not started this year, as last year the attendance fell off lamentably and moreover the staff is practically fully occupied with the existing course. We do not, however, refuse men who want training in special subjects for short periods if we can take such men in without dislocating existing work.

Details for the last eight years appear below :—

Details of students.	1915.	1916.	1917.	1918.	1919.	1920.	1921.	1922.
(1) First year students	35	54	58	61	60	89	84	67
(2) Second year students ..	29	23	36	39	46	50	53	65
(3) Third year students	31	35	23	35	38	48	49	57
(4) Short Course students ..	27		not held.		23	12	18	Nil.
(5) Special and Post Graduate students.	2	3	7	2	3	4	6	5
Total ..	124	115	124	137	170	203	205	194

The statement below shows the localities from which our students are drawn :—

Locality.	1915.	1916.	1917.	1918.	1919.	1920.	1921.	1922.
Deccan and Khandesh	20	14	9	19	27	38	29	29
Southern Maratha Country and Konkan	45	44	50	42	49	52	53	56
Gujarat	35	29	36	36	43	40	38	34
Sind	7	9	9	7	7	6	7	2
Assam	1	1	1	1	3	1	1	1
Central India	3	3	1	3	..	4	2	2
Nizam's Dominions	3	4	6	6	8	7	6	4
South India and Ceylon	7	6	5	13	16	23	18	10
Burma	1	2	5	6	7	19	30	32
United Provinces	2	3	2	2	1	2	..	..
Berar	..	..	..	1	..	..	2	3
Bengal	..	..	..	1	4	7	8	6
Central Provinces	..	..	..	..	5	4	4	3
Nepal	..	..	..	..	..	..	1	1
Idar State	..	..	..	..	..	..	3	..
Madras	..	..	..	..	..	..	3	10
Ajmer	..	..	..	..	..	..	1	1
Total ..	124	115	124	137	170	203	205	194

Classification of the students according to communities :—

	1915.	1916.	1917.	1918.	1919.	1920.	1921.	1922.
Brahmins	55	49	55	61	68	84	76	84
Marathas	5	4	4	6	16	20	21	21
Lingayats	4	3	2	2	1	5	10	7
Patidars (Gujarat)	3	4	10	13	12	7	5	4
Jains	..	..	..	..	6	4	1	2
Mahomedans	12	10	8	4	9	12	15	8
Parsis	15	15	12	7	5	5	2	3
Christians	1	1	..	..	7	16	21	20
Ceylon Students	..	..	..	..	6	7	2	2
Buddhists	..	..	..	..	7	9	16	17
Anavils (Surat)	..	..	..	..	..	..	2	3
Others	29	29	33	44	33	34	34	23
Total ..	124	115	124	137	170	203	205	194

Further classification shows that out of 121 students from the Bombay Presidency only 35 (or 29 per cent.) come from the four chief agricultural communities of the Presidency, *viz.*, Marathas and Lingayats in the south and Patidars and Anavils in the north.

COURSES.

The main course is the three years' course open to students qualified according to the rules of the Bombay University.

The Principal may also admit a few other students to the course, and the successful candidates receive the college Diploma. The number 37 admitted in the last seven years is as follows :—

	Per cent.
1916—12 out of 54 equal to	22·2
1917— 3 out of 58 equal to	5·1
1918— 8 out of 61 equal to	13·1
1919— 4 out of 60 equal to	6·6
1920— 7 out of 89 equal to	7·8
1921— 1 out of 84 equal to	1·2
1922— 2 out of 67 equal to	2·9

As a rule students of the Presidency proper are not admitted under these special conditions.

SCHOLARSHIPS.

The allotment during the last 8 years is as follows :—

	1915.	1916.	1917.	1918.	1919.	1920.	1921.	1922.
Deccan	..	3	3	3	5	7	4	6
Southern Maratha Country ..	5	5	7	2	4	4	2	6
Gujarat	2	2	3	6	3	1	2	2
Konkan	6	3	2	1	3	3	7	1

LIBRARY.

The Library now numbers 11,788 volumes out of which 310 were added in 1921-22.

OTHER INSTITUTIONS.

The other institutions mentioned in last year's report continue to be used for the teaching of students. The Mody Bag is now well on its way to be a first-class fruit garden.

COLLEGE GYMKHANA.

This body, which focuses the social activities of the student world of this College, has done excellent work in the past year. It is the boast of this college that it is the most sporting one in Poona. In the year under report the first Inter-collegiate athletic meeting was held in Poona when this College carried off both the individual and the College Championships. We shall do our best to defend these titles this year. An athletic secretary has been added to the existing functionaries.

We are still without a playing field due to the bad condition in which the Bombay Development Department left our playing field after removing the huts therefrom. The Y. M. C. A. have kindly let us use the ground acquired by them near the college as a temporary measure. We are grateful to Mr. Garland Craig of the Y. M. C. A. for the great interest he has taken and continues to take in the athletics of this college.

The following cup has been added by a generous donor to the list given in the last report :—

(1) Milking Competition—Wad Challenge Cup—Mr. M. D. Wad, Demonstrator in Dairying.

This college is strongly represented in D Company of the 1st Bombay Battalion, University Training Corps, I. T. F. The total number of present students in the Corps is 60.

We are often questioned as to what our graduates engage in after completing their college course. The following is a list for two years in addition to the list given in the last report :—

1921—Total Number 38—		1922—Total Number 44—	
Agricultural Department, Bombay ..	8	Agricultural Department, Bombay.	1
Private Farming ..	3	Private Farming ..	7
Co-operative Department, Bombay ..	2	State Service ..	6
Agricultural Department, Burma ..	1	Educational Department ..	4
Revenue Department, Bombay ..	2	Other bodies ..	2
Agricultural Departments, States ..	5	Not yet known ..	24
Other bodies ..	4		
Unknown ..	13		
	38		44

The details of the working of the Public Veterinary Hospital for the year are noted below:—

Patients treated.	1919-20.	1920-21.	1921-22.	Remarks.
Total	1,986	2,045	2,131	
Inpatients	412	515	514	
Outpatients	1,574	1,379	1,617	
Patients treated on tour	50	162	176	
Supplied with medicines	142	89	112	
Daily average attendance	36·44	36·49	41·57	
Inpatients	19·37	20·08	24·08	
Outpatients	17·07	16·41	17·49	
Free patients	998	1,116	1,032	
Paid patients	988	929	1,099	
Agricultural Animals	1,120	1,179	448	
Non-agricultural animals	866	866	1,603	
Castrations performed	3	69	99	(including caponising)
Attendance on Rinderpest	24	40	10	
Do. Foot and Mouth	3	1	10	
Do. Black quarter	..	1	..	
Do. H. Septicæmia	..	..	1	
Do. Glanders	..	..	1	
Do. Epizootic Lymphagitis	..	..	1	
Do. Fowl cholera	..	..	1	
Do. Pneumo Pericarditis	..	..	1	
Inoculations performed	1,380	1,088	154	

W. BURNS,
Acting Principal.

APPENDIX B.

ADMINISTRATIVE REPORT AND SUMMARY OF WORK DONE UNDER DEPUTY DIRECTOR OF AGRICULTURE, NORTH CENTRAL DIVISION, NASIK, 1921-22.

STAFF AND ORGANIZATION.

(1) By Government Order, Revenue Department, No. 2066, dated 13th August 1921, the proposals of the Director of Agriculture for a redistribution of the charges of Deputy Directors of Agriculture were approved. One of the results of this was the formation of a new charge, consisting of the three districts of West Khandesh, East Khandesh and Nasik. These districts were formerly part of the Central Division and under the control of the Deputy Director of Agriculture, Central Division, Poona. This new charge was designated the North Central Division and its headquarters fixed at Nasik.

(2) I took over charge of this new Division on the 16th August 1921 and commenced work at the new headquarters, Nasik, on the 7th September 1921. The intervening time was spent in separating out files and correspondence relating to my new charge from the original Central Division office at Poona.

I have remained in charge of the North Central Division throughout the year under report.

Mr. S. H. Prayag was appointed to the new post of Cotton Breeder, Khandesh.

The graduate staff at the commencement of work in the new Division consisted of :—

Mr. B. P. Wagholkar	..	Cotton Supervisor.
Mr. T. V. Nagarshet	..	District Agricultural Overseer, West Khandesh.
Mr. V. B. Parbhune	..	District Agricultural Overseer, East Khandesh.
Mr. N. V. Bhagwat	..	District Agricultural Overseer, Nasik.
Mr. G. S. Moghe	..	Farm Superintendent, Jalgaon.
Mr. R. M. Chaudhari	..	Graduate-in-training.

In addition, there were eleven non-graduate fieldmen, including Mr. P. S. Pandit, Farm Superintendent, Dhulia.

Mr. D. L. Joshi was appointed Head Clerk in the office of the new division, Nasik.

During the year under report, Mr. T. V. Nagarshet was transferred to the staff of the Deputy Director of Agriculture, Gujarat, and was succeeded on the 5th May 1922 by Mr. G. P. Jambhekar.

Mr. B. P. Wagholkar, Cotton Supervisor, was on leave from 22nd February 1922 to 12th June 1922 and, during that period, his duties were carried on firstly by Mr. Nagarshet and latterly by Mr. R. M. Chaudhari.

There were no changes in the remainder of the staff during the year under report.

(3) The work in the North Central Division is organised in three main sections—

(1) District Work Section.
(2) Farm Section.
(3) Cotton Section.

For the purposes of this report, it has been found convenient to deal with these separately, although there is a more or less close relationship between the work done in each. For instance the experimental results obtained on the farms form a basis for the introduction of improvements in crops, tillage methods and implements throughout the districts. Similarly the district cotton propaganda and organization is meantime dependent on the annual fresh supply of pure N. R. seed from the farms.

(4) *District Work Section.*—The work done in this section is primarily carried out by the District Agricultural Overseers and their respective subordinate staffs. In Khandesh in particular it is effectively supplemented by the work of Agricultural Associations. For the purposes of report, it has been divided into two sub-sections :—

(*a*) Khandesh.
(*b*) Nasik.

The Khandesh section is supervised by the Cotton Supervisor owing to the importance of the cotton crop in that particular tract. He has two District Agricultural Overseers under him, one in West Khandesh and one in East Khandesh.

The Nasik District is in charge of one District Agricultural Overseer.

District work consists primarily of experimenting with and bringing to the notice of the cultivator first hand, improved methods of agricultural practice, of enabling him to obtain readily, pure seeds, improved and new implements and effective manures, and of demonstrating to him on his own fields the advantages and profits accruing from effective employment of up-to-date methods and material.

In addition, district work includes the important function of assisting the agriculturists to organise for their communal benefit and of fostering all efforts towards co-operative agriculture.

(5) *Farm Section.*—There are two agricultural stations in the North Central Division, one at Jalgaon, East Khandesh, and one at Dhulia, West Khandesh. Their work is reported on separately in this report and nothing more need be added here. Jalgaon Farm is in charge of a graduate Superintendent, and Dhulia, of a non-graduate fieldman.

(6) *Cotton Section.*—The work in this section is practically confined to Khandesh and consists of two branches, firstly cotton breeding and research work and secondly the organization and distribution of pure N. R. seed. The first branch is now firmly established with the appointment of a Cotton Breeder in charge. The production and distribution of the pure N. R. seed in the district is in charge of the Cotton Supervisor. The work of each branch is separately reported on.

(7) In addition to the work done under the sections enumerated above, various items of what may be termed "Special Work" were undertaken and carried out. These include an agricultural survey of Pachora Taluka, East Khandesh, introduction of new crops, pig-killing experiments, etc., and will be dealt with in more detail at a later stage in this report.

GENERAL SURVEY OF SEASON.

(8) *Khandesh.*—The kharif season was characterised by a long break in the rains which set in shortly after the commencement of the monsoon. This delayed sowing operations considerably and affected the germination of the early sown crops. Good rains were experienced in July and August but in East Khandesh in particular, their distribution was not suitable for the effective accomplishment of inter-culturing operations. Heavy rains in September did some damage to the ripened crops. In general the rabi season opened favourably and sowings were timely and germination of crops good. This was not the case in some parts of East Khandesh where moisture was insufficient and crops accordingly stunted and weak. A heavy rainstorm, accompanied by hail, caused much damage to rabi crops in the early part of January in many places in the district.

On the whole, however, the season under report was good. Reports were received in December of damage caused to the wheat crop by rats. The groundnut and sugarcane crops were damaged in many cases by wild pig especially in the Tapti Talukas.

The attack of wilt disease on the cotton crop was especially severe in some districts this year.

(9) *Nasik.*—The monsoon commenced about the middle of June and till the end of August the rainfall was good except in the eastern portion of the district. In general, kharif crop returns were good. Timely rain fell in September and gave a good start to the rabi season. Later on, however, rains were neither general nor sufficient and dry crops such as wheat, linseed and gram were considerably affected.

Damage by wild pig was reported from Kalwan, Dindori and Chandor talukas.

(10) As in Khandesh, well water supply was very scanty and the grapevine and sugarcane crops suffered on that account.

(11) The condition of cattle was satisfactory over the whole division and the supply of fodder was sufficient.

DISTRICT WORK.

(12) The District Work done in the North Central Division, apart from the N. R. cotton organization, which has been reported on separately, can be classified under the following heads :—

(1) Demonstration and Experiment Plots.
(2) Implement and Seed Depôts.
(3) Agricultural Demonstrations.
(4) Seed and Implement Distribution.
(5) Agricultural Association Work.
(6) Special Work.

A certain amount of the work done on the Agricultural Stations also falls under the above headings but as these stations have been separately reported on, it is not necessary to recapitulate their share here. The farms have proved to be a very helpful supplement to the work of the district officers. It is becoming more and more obvious however that the farms have very definite limitations in their power for extension and propaganda work, which is carried on to much greater purpose in the districts and on the actual fields of the cultivators. For the purposes of report, the North Central Division, as already stated, is divided into two sections, Khandesh and Nasik. The work in Khandesh is supervised by two District Agricultural Overseers who are responsible, through the Cotton Supervisor, to the Deputy Director of Agriculture. This arrangement has worked well as the Cotton Supervisor is able thereby to co-ordinate his cotton work in the district and to give the District Agricultural Overseers the benefit of his wide experience of Khandesh agriculture.

The work in Nasik is supervised by one District Agricultural Overseer, directly responsible to the Deputy Director of Agriculture.

The new Divisional Board, appointed to co-ordinate the work of the Agricultural and Co-operative Departments in the Division, came into existence during the year under report and it is hoped that, as a result of this innovation, much progress will be made in the future, especially in the direction of extended agricultural propaganda and organization.

(13) (1) Demonstration and Experimental Plots.

As far as possible, all demonstrations of improved methods, and material are carried out on the fields of actual cultivators, as such are found to be much more convincing to the general body of agriculturists. In many cases, the work is done at the entire expense of the cultivator himself, whilst in others, seeds, manures, etc., are given by the Department free of charge or at very reduced rates. The District Agricultural Overseers and their staffs suggest the trials, supervise their execution and collect observations on, and results of, the work.

The Chilean Nitrate Committee supplied Sodium Nitrate free of charge for experimental purposes in the district.

(14) (*a*) Khandesh—*Cotton.*—The work in connection with this most important crop is practically confined to the demonstration of manurial treatment, which has been found beneficial and economical on the Government Farms. The application of castor cake as a manure to the cotton crop where farmyard manure is not available has given excellent results in the district. It is pleasing to note that a good many cultivators are adopting this treatment of their cotton crop of their own accord. Actual figures are not available but this ultimate and only test of the success of departmental demonstration is undoubtedly evident.

Tests to compare the return from the cotton crop on fields, ploughed with the iron plough with the return from unploughed fields are in progress and will be reported on when sufficient data are available.

Wheat.—Satisfactory results have been obtained in West Khandesh by sann green-manuring.

Rice.—Castor cake manuring—top dressing of 400 lbs. to the acre—was tried on Sathi rice in West Khandesh. The results were not good and further experiment to determine the effect of altering the time of application will be carried out.

Bajri.—Varietal trials of bajri—Akola variety *versus* local—have been held in East Khandesh. The results are in favour of the imported variety. Poudrette has been found a profitable manure for this crop at Nandurbar.

Sugarcane.—The shortage of water in the well-areas militated against the success of trials with this crop. The varietal test at Navapur is proceeding and shows results in favour of the Mauritius varieties.

Vegetable crops.—Manurial experiments with onions and chillies have been conducted and the results are somewhat conflicting. These experiments, however, are worth continuing under more standard conditions, and a new series has been laid down.

New crops.—The introduction of the potato crop into West Khandesh has been very successful and there is every prospect of its cultivation extending in Nandurbar and Navapur talukas of that district.

The following table summarises the yields obtained :—

Village of sowing.	Acreage sown.	Yield per plot in lbs.	Yield per acre in lbs.
	Gunthas.		
Nandurbar	2	302½	6,050
Pachorabari	1	186	7,440
Ghodasgaon	1	183	7,322
Taloda	1	187·1	7,485
Dondaicha	½	85·5	6,838

In East Khandesh, the crop has not been successful but its sowing was unduly delayed.

Turmeric, ginger and English vegetables have been successfully introduced into parts of the Khandesh tract.

(15) (*b*) Nasik—*Sugarcane.*—The area under sugarcane on the Girna canals has increased from 125 acres last year to 398 acres 26 gunthas during the year under report. On the Kadwa canals the acreage has decreased, due chiefly to the insufficient supply of water for cane-cultivation.

The method of wide-planting advocated by the Department is being widely taken up and improvements in crushing machinery and gul preparation are largely adopted over the sugarcane area.

In the Girna canal area especially much help and encouragement has been received from the officers of the Irrigation Department, in introducing improved methods of tillage to the cane-growers.

The use of sulphate of ammonia as a manure for sugarcane has now passed beyond the stage of demonstration and is becoming a matter of ordinary practice amongst the most intelligent

cultivators. The trials conducted by the Department this year show an extra profit, varying from Rs. 150 to Rs. 230 per acre to the cultivators using this manure.

Bajri.—As in Khandesh, varietal trials of Akola *versus* local varieties of bajri were instituted. The average extra yield per acre of the former amounted to 128 lbs. of grain valued at about Rs. 10. Superior yields of straw and bhusa were also obtained. Comparative trials of bajri sown on land ploughed with the modern iron plough against a similar crop taken from land ploughed by the local implements are in progress.

Rice.—Manurial experiments on the rice crop (Kamod) in Nasik taluka were not successful.

Wheat.—The effect of a special mixed manure on the wheat crop was tested but the results this year were not convincing. Further trials will be made.

Vegetable Crops.—A series of manurial experiments on onions were conducted and successful results obtained.

The following table shows the details of these experiments conducted on plots near Nasik Road Station :—

Area of plot in gunthas.	Manurial treatment per acre.	Yield of plot.	Yield per acre.	Difference in yield per acre.	Net value of difference at Rs. 18 per 800 lbs.
		lbs.	lbs.		Rs.
5	400 lbs., Nitrate of Soda	2,400	19,200	3,840	86·4
5	400 lbs., Castor cake .. .. / 40 „ Sulphur of Amonia	2,394	19,152	3,792	85·2
5	200 lbs. Special Manure (Union Agency) white.	3,084	24,672	9,312	209·4
5	200 lbs. Special Manure (Union Agency) black.	3,162	25,296	9,936	223·8
5	20 cart-loads F. Y. M.	1,920	15,360	....	....

Similar profitable results were obtained by a similar experiment conducted in Niphad Taluka.

Trials of manurial treatment for the garlic crop were also conducted but data is not yet available.

New Crops.—Peas were introduced as a new field crop in the Nasik District. 480 lbs. of green pods were harvested from a 20-guntha plot and were sold in Nasik at annas 2 per pound, *i.e.*, Rs. 120 per acre.

(16) The following table is a summary of the demonstrations and experiments conducted in the North Central Division during the year under report :—

Nature of Crop Demonstration or Experiment.	Number of Plots in		
	Nasik.	East Khandesh.	West Khandesh.
Cotton—			
Tillage	..	6	2
Manurial	6	12	4
Bajri—			
Varietal	12	8	..
Manurial	..	..	2
Tillage	2	..	..
Rice—Manurial	5	..	6
Wheat—Manurial	12	..	2
Sugarcane—			
Tillage	14	..	7
Manurial			
Varietal	..	..	6
Onions—Manurial	10	4	2
New Crops—			
Peas	9	..	..
Potato	..	3	5
Turmeric	..	..	1
Ginger	..	..	1
Groundnut	2	..	..
Miscellaneous	7	..	2
Total ..	79	33	40

The district work done by Agricultural Associations, particularly in Khandesh, is reported on in another section of this report.

(17) It is gratifying to note that many cultivators are adopting more and more of their own free will, agricultural practices, which were originally demonstrated in the district by the Department. In some cases, such as groundnut (improved varieties) cultivation, manuring with sulphate of ammonia for sugarcane and castor cake for cotton, this acid test of the success of departmental work is very obvious. However a good deal of apathy still exists and, in spite of the undoubted success and profit which attend the adoption of new methods by their neighbours, many cultivators still appear lethargic and unwilling to follow their example in agricultural practice. In the future, without relaxing departmental effort, it is hoped that, by a gradual extending of local and unofficial interest in the direction of agricultural propaganda and organization, this apathy will be overcome and more general enthusiasm awakened throughout the whole Division in all matters relating to agricultural progress.

(18) (2) *Implement and Seed Depôts.*—At certain selected centres in the Division, the Agricultural Department maintains depôts where, at a nominal rate, cultivators can obtain new and improved implements on hire or purchase. These also serve as distribution centres for seed, etc.

It is evident that private enterprise is tending to replace departmental effort in this branch of the work and such a change would be most welcome and beneficial.

The demand for implements on hire is steadily growing in the Division and the following table shows the figures of hire receipts during the last four years at the various depôts in existence.

Serial No.	Name of Depôt.	Name of Taluka.	Hire receipts received during				Remarks.
			1918-19.	1919-20.	1920-21.	1921-22.	
			Rs. a.	Rs. a.	Rs. a.	Rs. a.	
1	Nasik ..	Nasik ..	141 4	101 10	64 9	113 4	
2	Chandwad ..	Chandwad ..	..	100 14	124 8	216 4	
3	Brahmangaon ..	Baglan ..	161 15	158 6	199 1	402 14	Depôt now moved to Dabhadi.
4	Ozar ..	Niphad ..	30 8	68 6	106 1	41 11	Most of implements moved to other depôts.
5	Jalgaon Farm ..	Jalgaon ..	25 3	92 9	155 2	369 15	See Footnote 1. See Farm Report.
6	Chalisgaon ..	Chalisgaon ..	45 8	78 9	71 15	139 14	See Footnote 2.
7	Amalner ..	Amalner ..	15 0	42 10	69 4	90 0	See Footnote 3.
8	Ner ..	Dhulia ..	11 0	29 9	18 10	158 0	
9	Nandurbar ..	Nandurbar ..	5 7	0 12	10 10	16 4	
10	Dhulia ..	Dhulia ..	..	..	10 12	3 8	Depôt reopened on 1st May 1922.
		Total ..	436 13	673 5	830 8	1,551 10	

The above figures do not include hire receipts for June 1922. The chief demand for implements for hire is for iron ploughs especially BT2, CT2, Kirloskar and Wiard makes.

(19) Many of the Agricultural Associations in Khandesh possess a stock of implements for hire and special report on this branch of their work will be found later. Other Associations who do not possess a stock of their own implements have made application to the Department for the loan of a few for the benefit of their members. Wherever possible, such requests have been granted.

(20) From the above statement of hire receipts it will be seen that the hiring of implements, in addition to providing facilities for the poorer cultivator who is unable to meet the initial cost of actual purchase, is also a remunerative business proposition for any firm desirous of popularising their implements in the districts. Any step in this direction by the manufacturers of improved implements would be most welcome and would relieve the district departmental officers for the important work of experiment and demonstration with suitable types.

(21) (3) *Agricultural Demonstration.*—During the year under report, eight large demonstrations were held, where the departmental officers brought to the notice of many cultivators, the improvements in methods and material, advocated by the Department and gave short lectures on matters of agricultural interest. Such demonstrations are, in many cases, arranged to coincide with fairs, large bazaars and meetings and have proved successful in interesting the large numbers of agriculturists, who gather on such occasions. The cost of such work is not great, and its immediate results, in the increased demand for new implements, manures, seeds, etc., are very satisfactory.

(1) Includes Rs. 325-1 for hire of implements placed on Farm by Rao Saheb Rupchand Motiram.

(2) Includes Rs. 39-13 for hire of implements lent to depôt by Jalgaon Farm and Rs. 51-4 for hire of implements belonging to Pachora Agricultural Association.

(3) Includes Rs. 26-0 for hire of implements lent to depôt by Jalgaon Farm.

The following statement shows the places where and when the above-mentioned large demonstrations were held and gives details of their main object and the approximate number of cultivators attending:—

Place of Demonstration.	District.	Date on which held.	Main object of Demonstration.	Number attending (approximately).
Ghoti ..	Nasik ..	18th February 1922	In connection with Cattle Show .. Improved manures, seeds and implements.	500
Pimpari ..	Nasik ..	12th March 1922 ..	Actual crop tillage methods in fields. Sugarcane cultivation and manuring. Lucerne cultivation.	250
Aghar ..	Nasik ..	26th March 1922 ..	Cane crushing with Chatanooga Mill. Poona Furnace and gul preparation	150
Belgaon ..	Nasik ..	14th May 1922 ..	Silo and preparation of ensilage .. Working of improved implements.	300
Pahan ..	East Khandesh ..	17th January 1922.	Improved implements, etc. ..	250
Sindad ..	East Khandesh	1st February 1922.	Do. do. ..	300
Nagardevla ..	East Khandesh	10th February 1922	Do. do. ..	300
Chavalkheda ..	East Khandesh ..	3rd April 1922 ..	Do. do. ..	700

On all the above occasions, lectures were delivered, questions called for and answered and advice given by members of the Department and other helpers.

(22) In addition to the above, very many minor demonstrations were held throughout the Division at which some particular improvement was shown to the cultivator and advice and help given. These were in some cases, particularly in Khandesh, conducted by Agricultural Associations with the assistance of the District Agricultural Overseer and his staff.

The use and actual working of improved ploughs, chaff-cutters, stone roller, hand hoes, levellers, etc., and the approved methods of rice, cotton and sugarcane cultivation, were popular subjects at such small demonstrations.

In Khandesh, 63 demonstrations of the above type, were held throughout the district.

(23) As in the case of all district propaganda work, the ultimate test of practical success is the extent to which the improvements shown are incorporated in the agricultural practice of the average cultivator. There are distinct signs, as may be seen from the increased receipts for hire of implements and the growing demand for manures and seeds, that this is happening. It is anticipated that, with the growth of activity of local bodies, such as Agricultural Associations, in this type of work, the rate of progress will be considerably accelerated.

(24) (4) *Seed, Manure and Implement Distribution.*—The following statement shows the distribution of various seeds, manures and implements by the district staff during the year under report:—

Nature of Article.	District.						Total Quantities Distributed.
	Nasik.		East Khandesh.		West Khandesh.		
	Quantity.	Cost.	Quantity.	Cost.	Quantity.	Cost.	
Seeds, etc.	lbs.	Rs. a.	lbs.	Rs. a.	lbs.	Rs. a.	lbs.
Wheat ..	3,096	516 0	..	..	1,200	140 0	4,296
Bajri ..	7,101	787 9	601	10 0	....	..	7,161
Jowars ..	50	10 0	178	27 0	....	..	228
Lucerne ..	32	80 0	..	..	37½	75 3	69½
Maize ..	20	2 8	..	..	....	..	20
Groundnuts ..	2,410	291 8	..	..	....	..	2,410
Onions ..	47	119 0	..	..	....	..	47
Castor-Seed ..	..	..	..	..	3,404	374 12	3,404
Potato ..	..	..	196	39 0	134	27 9	330
Turmeric ..	..	..	1,000	100 0	....	..	1,000
Sann ..	172	16 0	..	..	....	..	172
Bhendi ..	54	43 0	..	..	....	..	54
Rice ..	20	1 10	..	..	....	..	20
Peas ..	33	5 8	..	..	....	..	33
English vegetables ..	5 ozs.	15 0	21 ozs.	28 0	....	74 11	
Kulith ..	60	7 8	..	..	....	..	60
Miscellaneous	12	1 4	..	..	16 plants	18 0	
Orange plants ..	..	..	..	..	200 ,,	315 0	200 plants
Mangoes ..	..	..	..	..	24 ,,	50 0	24 ,,

Nature of Article.	District. Nasik. Quantity.	Nasik. Cost.	East Khandesh. Quantity.	East Khandesh. Cost.	West Khandesh. Quantity.	West Khandesh. Cost.	Total Quantities Distributed.
Implements, etc.	lbs.	Rs. a.	lbs.	Rs. a.	lbs.	Rs. a.	lbs.
Ploughs ..	27	1,723 8	2	130 0	....	..	29
Sprayer ..	1	22 0	..	..	....	..	1
Spare parts, etc. ..	12	50 2	2	17 0	....	..	14
Iron Mhots ..	..	..	2	44 0	5	106 4	7
Secateur ..	..	..	..	..	1	10 12	1
Spray Pump ..	..	..	1	40 0	....	..	1
Manures, etc.							
Castor-cake ..	6,020	212 12	4,480	175 0	....	..	10,500
Artificial ..	295	55 12	424	92 0	112	17 9	831

(25) To summarize in the Division, during the year under report, the distribution, by the district staff was as follows :—

		Rs. a.
Seeds 19,304½ lbs.	valued at	2,674 15
Plants 240	,, ,,	383 0
Implements, etc.	,, ,,	2,143 10
Manures 11,331 lbs.	,, ,,	553 10

The above table does not include distribution from the farms which is reported on separately or from the Agricultural Associations, which take a big share in this work in Khandesh.

(26) On the canal areas in the Nasik district, 75,200 lbs. of sulphate of ammonia and 238,560 lbs. of castor cake were distributed through private agencies.

(27) (5) *Agricultural Association Work.*—In view of the new scheme, approved by Government, whereby it is hoped to hand over a large share of the district propaganda work to representative local bodies with the taluka as a unit and to assist and advice them in their work, the present Agricultural Associations in existence assume a new and wider importance.

They form a nucleus around which the more representative taluka associations, essential to the success of the above scheme, may be built up and serve as a starting-point for all types of organised agricultural effort.

The North Central Division, especially Khandesh, is fortunate in the number of existing Agricultural Associations.

The effectiveness of these, as is to be expected, varies greatly but much good work has been done by them during the year under report.

A large portion of the work of the District Agricultural Overseers has been to assist, supplement, and, where necessary, stimulate the efforts of the Associations. They, in return, have in many cases successfully cooperated with the Department in district work.

The following statement will afford some idea of the work done during the year by Agricultural Associations in Khandesh :—

Serial No.	Name of the Agricultural Association.	Field-men kept.	Number of Demonstration held.	Implement Depôt maintained	Receipts from Hire of Implements.	Distribution of Seed.	Distribution of Manure.	Distribution of Copper Sulphate.
	East Khandesh.				Rs. a.			
1	Pachora Agricultural Association.	2	18	Yes ..	246 12	91 lbs. 10 ozs.	1,109 lbs.	400
2	Jalgaon Agricultural Association.	1	19	Yes ..	75 0	301 lbs 4 ozs.	809 lbs.	200
3	Rawer Agricultural Association.	1	4	Yes ..	129 10	2 ozs.	200 lbs.	348
4	Edalabad Agricultural Association.	1	..	Yes ..	75 0	Not	known.	
5	Bhusawal Agricultural Association.	1	9	Yes ..	20 0	20 lbs.	100 lbs.	200
6	Chopada Agricultural Association.	1	3	Yes ..	56 0	121 lbs. 10 ozs.	462 lbs.	200
7	Erandol Agricultural Association.	Reports not received.						
8	Yawal Agricultural Association.							
9	Amalner Agricultural Association.							

Serial No.	Name of the Agricultural Association.	Field-men kept.	Number of Demonstrations held.	Implement Depôt maintained	Receipts from Hire of Implements.	Distribution of		
						Seed.	Manures.	Copper Sulphate.
	East Khandesh—concld.							
10	Jamner Agricultural Association.		Report not received.					
	West Khandesh.							
11	Dhulia Agricultural Association.	1	..	..	..	..	..	
12	Shirpur Agricultural Association.		Maintains a stock-breeding farm only.					
13	Sindkheda Agricultural Association.	1	..	Yes ..	..	..	..	
14	Shahada Agricultural Association.	..	..	..	..	..	..	
15	Nandurbar Agricultural Association.	..	..	..	..	..	..	

(28) In addition, many of the above associations held demonstrations and experiments with departmental assistance, on the fields of their members. The funds of Pachora Agricultural Association—one of the best in the district—are given out on loan to cultivators through the credit societies, for land improvement. The associations at Dhulia and Jalgaon are both progressive and along with Pachora take an active part in assisting departmental work such as pure N. R. cotton seed distribution, district work, etc. The associations at Shirpur and Jamner have gone in particularly for breeding work with the local types of cattle.

(29) In Nasik district, there are only two Agricultural Associations; one at Chandwad, the other at Yeola. Neither can be said to be very enterprising, although Chandwad Association recovered Rs. 48-8 for hire of implements to the members. The possibility of increasing the number of associations and increasing their effectiveness in Nasik district has been considered and work to that end is now in progress.

(30) (6) *Special Work.—Agricultural Survey of Pachora Taluka.*—The Pachora Agricultural Association, having made application to come under the new scheme of taluka associations, subsidized by Government, an agricultural survey of the taluka was conducted in accordance with the preliminary requirements of the scheme. The object of the survey was to determine, as far as possible, the actual difficulties and requirements of the cultivators firsthand with a view to the more efficient construction of a programme of work for the ensuing year.

This survey was carried out by Mr. B. P. Wagholkar, Cotton Supervisor, assisted by Mr. R. M. Chaudhari, and their work in this connection was very creditable.

A special report was submitted on the results of the survey and the Deputy Director of Agriculture, in consultation with the officials of the Pachora Association, framed a budget and drew up a scheme of work which was approved by the Director of Agriculture and the Divisional Board.

The control of the propaganda and organization work in the Pachora Taluka has now been vested in the taluka association, who, with the assistance of the department, are supervising the execution of the scheme of work above mentioned.

(31) *Pig-killing Experiments in Nasik District.*—Many complaints were received directly or indirectly from cultivators with reference to the damage caused by wild pigs and other animals to the crops. This seemed to be especially severe in the Kalwan, Chandwad and Dindori talukas of Nasik district.

Accordingly experiments on the destruction of wild pigs by arsenical poison baits were tried at two places.

The results are tabulated below :—

No.	Place.	Taluka.	Number of Nights.	Number of Baits.	Baits untouched.	Baits taken.	Results.
1	Maodi ..	Dindori ..	3	72	68	4	2 wild pigs were found poisoned.
2	Bej ..	Kalwan ..	6	162	135	27.	11 pigs, 2 jackals and a number of rats were found poisoned.

As the grant for these experiments was received very late in the year and most of the crops had been harvested, more work of the nature was not undertaken during the year under report. It seems probable that some form of cooperative action, directed towards the actual protection of the fields will prove more effective and economical than the spasmodic destruction of a few animals causing the damage.

(32) *Silo at Belgaon near Nasik.*—The demonstration silo at Belgaon near Nasik was filled for the third time by the owner himself who was very satisfied with the results obtained last year. 24,506 lbs. of grass were put into the silo at a cost of Rs. 91-13. On the silo being opened, the weight of ensilage was estimated at 16,660 lbs. by about 68 per cent. of grass originally put in.

Samples of the ensilage have been sent to the Agricultural Chemist, Poona, for analysis.

(33) *Insect Pest and Fungoid Diseases.*—No very serious attack on crops by insect pests or fungoid diseases was reported from the districts during the year under report.

The distribution of packets of copper sulphate for steeping jawar seed as a preventitive against smut, was extended.

In Nasik district, the use of Bordeaux mixture for spraying grape-vines is now quite a common practice.

At Wadner in Chandwad taluka, a species of bug locally known as "meru" attacked the betel-vine plantations, causing spotting and curling of the leaves. On the advice of the expert in Poona, a soap spray was tried in three plantations with satisfactory results. The cultivators were impressed by the efficacy of the remedy and 50 lbs. of soap were ordered by them and many plantations were given similar treatment.

Aphis attack on lucerne was successfully combated with kerosine spraying in five centres.

(34) *Miscellaneous Work.*—The district staff contributed many articles of agricultural interest to various agricultural magazines and publications.

Four members of the staff attended the course for district Agricultural overseers, organised by the Director of Agriculture at Poona.

Mr. S. H. Prayag, Cotton Breeder attended the Science Congress held at Madras and read a paper on "Varieties in the Gossypium Neglectums".

Many applications for advice and help were received throughout the year from cultivators both in person and by letter. All these were attended to.

FARM SECTION.

(35) (*a*) *Jalgaon Farm.*—This farm of 204 acres 31 gunthas produces annually a fresh supply of pure N. R. seed for distribution to registered seed growers and others. Thus the farm may be considered as the base for the cotton seed organization in the Khandesh tract. In addition the farm is a centre whereon the manurial and rotational problems of the chief crops of Khandesh are studied and new implements suitable to that tract experimented with.

The farm depôt for supplying implements on hire and on sale to the cultivators is widely known and popular.

(36) *Season.*—The monsoon broke about the middle of June and about 80 per cent. of the sowings were completed when a long break in the rains set in. This dry spell, which was accompanied by strong winds, had a bad effect on the newly germinated crops. The fodder crops of maize and sundhia suffered most. On the 9th of June, rain again fell, and the sowings were completed. There was much rain throughout July and August and intertillage operations were hindered thereby to some extent.

The rabi sowings were up to time and germination was excellent. In the month of January, a heavy rain-storm, accompanied by hail did much damage to the rabi crops, especially wheat and coriander. This latter crop was almost entirely lost as the ripened grain was shaken out on to the ground. The wheat crop was also damaged by rats.

The total rainfall during the year under report was 28 inches 61 cents *i.e.*, 2 inches 74 cents above normal.

(37) *Crops.*—During the year under report the area under different crops was as follows :—

Crop.	Area.	
	Acres.	Gunthas.
Cotton ..	129	33¾
Jawar and Udid ..	15	15¼
Wheat ..	19	17¼
Gram ..	4	19
Coriander ..	3	28
Groundnut ..	20	24
Total ..	193	17¼

(38) *Cotton.*—The area under cotton was manured according to the following scheme which has been in vogue on the farm during the last few years :—

Manure used per acre.	Acreage.		Average yield per acre in lbs. of seed-cotton.	Average yield per acre in lbs. seed cotton during preceding 5 years.
	Acres.	Gunthas.		
Farmyard Manure 15 cart loads per acre	59	25	634·46	603·75
Crude Night Soil 30 cart loads per acre	8	15	869·25	906·1
Sheep folding 2,000 sheep per acre per night	4	..	735·5	559·74
Castor Cake 400 lbs. per acre	53	10	620·44	531·7
No manure	4	23¾	472·13	269·37

The amount per acre of farmyard manure applied was reduced from 20 cart loads of previous years to 15 cart loads. The attack of cotton wilt disease was especially severe this year on the plots manured with crude night soil.

Castor Cake *v.* Moha cake.—As the price of castor cake is rising year by year, a trial was conducted to find out to what extent, moha cake could be utilised as a substitute for castor cake in cotton manuring. The yield of seed cotton from the moha cake manured plots, though not so great as that obtained by castor cake manuring, was satisfactory and the experiment is being carried on. The farm lint was sold in one lot of 100 palas by auction and fetched Rs. 10,600. The market rate for the local Khandesh mixture on the day of the sale was Rs. 100.

The farm supplied 32,000 lbs. of pure N. R. cotton seed to the Cotton Supervisor for distribution.

(39) *Jawar and Udid.*—The yield of jawar per acre was excellent averaging 1,174 lbs. of grain and 2,248·5 lbs. of karbi. An attack of stem borer—chilo simplex—affected the quality of the karbi but, as the crop was well advanced, the yield of grain did not suffer to any appreciable extent.

The udid crop was badly attacked by the larvæ of Hirse convolvuli and had to be entirely destroyed in some plots. A special report regarding this pest was submitted by members of the Farm staff.

(40) *Wheat.*—The yield of this crop was low chiefly on account of the damage caused by rats. Poison was employed in order to destroy these vermin.

(41) *Coriander.*—A most excellent yield was anticipated but, as has been already stated, the untimely hail storm at the beginning of 1922 shook the riepened grains on to the ground and the crop was a complete failure.

(42) *Gram.*—The average yield per acre was 419·44 lbs.

(43) *Groundnut.*—The average yield per acre was 1597·37 lbs. pods and 1,645 lbs. haulms.

(44) *Fodder Crops.*—In order to supplement the fodder supply of the farm, a small area of maize and sundhia was cultivated. These crops suffered from the early break in the rains but a fair yield of green fodder was obtained.

(45) *Farm Depôt.*—The Farm Implement depôt is becoming very popular and cultivators came from long distances to obtain ploughs, etc., on hire. As the ordinary stock of departmental implements were found insufficient to cope with the demand, a private gentleman, Rao Saheb Rupchand Motiram offered to purchase fourteen ploughs to be kept on the farm. These implements were to be hired to the cultivators and suprevision charges deducted from the hire receipts for the farm. This offer was accepted.

The details of the hire of implements are as under :—

Description.	Nature and number of implements.					Total.
	BT2 Ploughs. 9	CT2 Ploughs 4	Kirloskar No. 100 5	Wiard No. 12 2	Chaffcutter Simplex.	
	Rs. a.	Rs. a.	Rs. a.	Rs. a.	Rs. a.	Rs. a.
Farm Depôt Implements ..	48 3	25 0	41 0	....	14 11	128 14
Rao Saheb Rupchand Motiram's Implements.	144 7	75 0	58 8	47 2	....	325 1

(46) *Miscellaneous.*—The annual demonstration of farm crops, new implements and improvements in manurial and tillage treatment was held on the 23rd and 24th September. The Director of Agriculture and the Collector of East Khandesh were present on the opening day. 203 cultivators and 37 students, as well as many members of the district staff, attended the demonstration.

Trials of Harvesting and Plucking Groundnuts.— In view of the shortage of labour available for the harvesting of the groundnut crop in Khandesh, a series of trials were held on the farm to find out to what extent suitable implements could replace human labour in harvesting and plucking this crop.

For uprooting the crop, the potato digger and the Wiard plough were experimented with and compared with local methods. The soil conditions at the time of the test were somewhat unusual and it is intended to continue the trial over another year before conclusions are arrived at.

The plucking tests were made by wheat thresher and by the comb introduced by Mr. P. C. Patil, Deputy Director of Agriculture, C. D. In the former case, it was found that a subsequent cleaning was necessary and it is probable that better results would be obtained if a winnower was employed after the plucking operation. The comb did not give very satisfactory results. These test will also be conducted again next year.

During the year under report, 596 visitors, including cultivators, government officers and students visited the farm.

(47) (*b*) *Dhulia.*—This small station of 28½ acres—22 acres under cultivation—has been selected as the headquarters of the Cotton Breeder, Khandesh, whose work is reported on in a later section of this report. The other features of the farm are N. R. cotton cultivation under local conditions, a fruit orchard and a distribution centre for seed and implements. The cropping scheme of the farm had been fixed for the year under report by the Deputy Director of Agriculture, C. D. prior to the redistribution of charges and no radical change was introduced.

(48) *Season.*—The monsoon broke on the 6th June but sowing could not be commenced until the third week of that month. Sowing operations were finished by the end of June but a break in the rains which then ensued, had an adverse effect on the newly-germinated crops. The bajari crops had to be resown in parts. The last fortnight of July and the first fortnight of August were characterised by heavy rainfall—15 inches 52 cents—and this excessive precipitation was also harmful. Favourable conditions were prevalent during the latter half of August and September.

The land was prepared for the rabi crops in good time and sowings were made rather earlier than usual. The early sown wheat was affected by the heat during October but improved in November and a normal crop was anticipated. However this crop was greatly damaged by a severe hail storm during the first week of January and also in February. The cotton bolls opened regularly and were not discoloured by the late rains. On the whole, the kharif season was more favourable to crop growth than the rabi. The total rainfall amounted to 30 inches 38 cents, *i.e.*, 5 inches 69 cents above normal.

(49) *Cotton Crops.*—Exclusive of 2 acres allotted to the Cotton Breeder for experimental purposes, 8 acres 37½ gunthas of the farm were under N. R. cotton. The average yield was 726·25 lbs. seed cotton to the acre and the average ginning per cent. of the crop was 37·5. The farm lint was sold in one lot at Rs. 105 per palla—the market quotation for local Khandesh mixture on the day of the sale being Rs. 93. 2,000 lbs. pure N.R. seed was supplied from the farm to the Cotton Supervisor for distribution.

The comparative manurial experiments with crude night soil (30 carts per acre) and Farm Yard Manure (30 carts per acre) which have been proceeding since 1916-17 do not appear to be at all conclusive and this year's result cannot be said to appear to throw much light on the matter. The field on which this trial is being conducted is liable to water-logging after heavy rain and this year the cotton growing on the heavily manured plots suffered to a greater extent after the excessive downpours of August and September.

The rotation experiment of cotton—groundnut *versus* cotton—bajri has also been proceeding since 1916-17 and the results in favour of the former rotation—which are fairly consistent—were again exemplified this year in the yields of seed cotton obtained. The introduction of groundnut into the rotation in Khandesh is limited by the present scarcity of labour available at harvest time.

The result of this experiment for the last four years are tabulated below :—

Year.	Yield in lbs. per acre.				Remarks.
	Cotton.	Bajri.	Cotton.	Groundnut.	
		Grain. Fodder.			
1918-19 ..	60½	.. 1,378	106	328	Famine year.
1919-20 ..	951	692½ 2,500	1,228	467	Groundnut crop damaged by wild pigs.
1920-21 ..	595	765 1,714	658	604	
1921-22 ..	745	1,321 3,123	839	1,349	

(50) *Fruit Culture.*—The orchard on the farm has not been thriving well and during the year under report, work has been undertaken on the following lines :—

(1) Improving drainage of orchard.

(2) Replacement of grape-vines, figs, guavas and mangoes by Mozambique oranges.

A nursery for the propagation of fruit trees suitable to the district is also being established.

(51) *Miscellaneous.*—The experiment on the cultivation of tarvad—cassia auriculata—as a field crop is in progress and the effects of pruning and manuring with F. Y. M. are being observed.

(52) *Seed and Implement Depôt.*—The cultivators in the district appreciate the farm as a centre where seeds and implements can be obtained and where advice and help are readily available. During the year under report, 57 iron mhots were obtained and supplied to cultivators in the surrounding district.

There were many visitors to the farm throughout the year. An invitation to visit the Farm was extended through the Collector to representative cultivators of the district who had come to Dhulia to attend a meeting. Nearly 200 accepted and were shown round the farm.

COTTON BREEDING WORK.

(53) The desirability, from an economic standpoint, of closer scientific research into the cottons of Khandesh has been recognised for a long time. The success which has attended the introduction of pure N.R. cotton in place of the local Khandesh mixture and the great demand for seed of the pure variety have shown that the intelligent Khandesh cultivator is fully aware of the advantages which the pure variety offers to the grower. The record of receipts obtained from sales show also that the buyers realise the additional value of the variety recommended by the Agricultural Department.

In spite of this, it was felt, that although improvement had been made, the best and most profitable cotton for the Khandesh district had not yet been discovered and that much advance might be made, especially in the direction of improved staple, without losing the high ginning percentage characteristic of the pure N.R. variety.

(54) With this object in view, Mr. S. H. Prayag was appointed on the 22nd June, 1921 to the newly-created post of Cotton Breeder, Khandesh.

He commenced a detailed study of the local cottons of Khandesh and of many other varieties which might prove suitable for that tract. Although his work has only been in progress for one year and no conclusions can yet be drawn, the results obtained are distinctly promising and it does not seem unjustifiable optimism to look forward to the evolving of a strain, as the result of future work, which will be as superior to N.R. as that variety is at present to the local Khandesh mixture.

(55) Dhulia Farm, on account of its irrigation facilities, etc., was selected as headquarters of the Cotton Breeder's work and a small plot was also set aside on Jalgaon Farm and placed at his disposal. Owing to a break in the rains, the sowings at Dhulia had to be done under irrigation and were not completed until the 11th July. This unavoidable delay reacted to some extent on the yield.

The following varieties were sown on the experimental plots at Dhulia Farm :—

(*a*) N.R., N.R.C., N.V., N.V.M., N.V.K. These are the chief varieties composing the local Khandesh mixture.

(*b*) Bani.

(*c*) Three types of Bani x Comilla crosses.

(*d*) Big-bolled N.R. and Rosea strains grown on Dharwar Farm.

A detailed study was made of plants of the above types at all stages of their growth and, in addition to botanical features of importance, data were obtained with regard to measurement and time of opening of bolls, yield, length and character of staple and ginning percentage.

Protection of the flowers of many plants by rings to ensure selfing was also done.

The final number of plants examined was as follows :—

(*a*) 100 plants each from Neglectum varieties.

(*b*) 50 plants from unit selection work of previous years.

(*c*) 161 plants from Bani x Comilla crosses at Dhulia.

160 plants from Bani x Comilla crosses at Jalgaon.

(*d*) 50 plants of Bani type—Only 50 plants were retained for study in this plot as there was found to be considerable admixture of Neglectum types which was difficult to detect in the early stages of growth.

(56) One would indeed be rash to attempt to draw any conclusions as the results of one year's work, but it is possible to indicate the lines along which there seems most promise of future progress. On the whole, the hybrid plants of Bani x Comilla gave the most promising

results. However the splitting observed was considerable indicating mixed descent of the parent types Bani and Comilla. A large number of flowers in this class was selfed with a view to purification.

The following numbers indicate some of the material which is available for future work :—

Number of Plant.		Yield of Seed-Cotton in grms.	Staple in mill-metres.	Ginning %.	Remarks.
BxCXX	6	8·5	19·	37·6	Low yield may be due to late sowing.
BxCXX	27	21·	17·5	35·7	
BxCXX	24	11·5	17·	39·1	
BxCXX	49	18·	16·	38·8	
BxCXI	41	25·5	18·	37·2	

If some of these selected plants remain pure, the results will be most encouraging, but if splitting continues, a continuous rigid selection will be maintained to evolve the best of the strains. Of the different types of Neglectums introduced from other farms, the big-bolled N. R. made a good stand, and gave a satisfactory yield. The rosea varieties from Dharwar were slightly superior as regards staple to the N. R. big-bolled and blackseeded. Attention was also paid to the isolation and purification of the most promising strains in N. V. and N. R. The chief drawback to N. V. is its somewhat late and defective boll opening and, although early strains were observed this year, their yield, staple and ginning percentage were not satisfactory. N.V.M. has shown much variation and is not superior to N. V. whilst N. V. K. gave poor results in staple and ginning percentage. N. R. C. has not been found superior to good plants of N. R. though, on the whole, its mean yield and ginning percentage were better.

The Bani crop was a hopeless mixture and scarcely one pure plant of Bani could be obtained.

DISTRICT COTTON WORK.

(57) In the North Central Division, the district cotton work is practically confined to Khandesh and takes the form of popularising the pure N. R. seed advocated by the Agricultural Department and of organising its production and distribution. This work is supervised by a Cotton Supervisor, Mr. B. P. Wagholkar, whose headquarters are at Jalgaon.

(58) The pure N. R. seed produced annually in the Khandesh districts and controlled directly or indirectly by the Department is classified as :—

First Class Seed, i.e., seed produced on the Government Farms of Jalgaon and Dhulia.

Second Class Seed, i.e., seed produced by registered seed growers, seed unions, agricultural associations, etc., from first class seed supplied the year previous from the farms, *i.e.*, second generation from the farm seed.

Great difficulty has been experienced in maintaining any control over the purity of seed beyond this second generation off the farm ; especially when in the hands of individual private cultivators. This year an effort has been made to minimise this difficulty by distributing as much as possible of the second class seed to co-operative bodies such as seed societies, credit societies and agricultural associations who have a greater interest in maintaining its purity and who, obviously, are more powerful factors than individual cultivators in further distribution of the seed.

(59) *First Class Seed.*—During the year under report, Jalgaon and Dhulia Farms together produced 36,000 lbs. of N. R. seed available for distribution. This first class seed was distributed as follows :—

	lbs.
21 Registered Seed Growers, Khandesh	15,350
2 Registered Seed Growers, Nasik	3,480
Agricultural Associations—	
Jalgaon	4,000
Dhulia	3,000
Seed Unions—	
Hambardi, Undirkheda	4,600
Others	2,800
Total ..	33,230

2,770 lbs. were reserved in stock against any emergency, such as necessity for second sowing, which might arise.

The demand for this first class seed and the applications received from cultivators willing to become registered seed-growers were greatly in excess of the number that could be entertained.

The following table shows the actual quantities distributed and the area under first class seed in the Division :—

District.	Amount of Seed Distributed (lbs.)	Acreage (approximate) under first class seed.
East Khandesh	23,950·	1,497·
West Khandesh	3,000·	187·5
Nasik	3,480	217·5
Total for N. C. D.	30,430	1,902·
Other Districts	2,800	175·
Grand Total ..	33,230	2,077

This area, given a normal season during the ensuing year should provide second class seed for an area equal to 35,000 acres next year.

First class seed was supplied amongst others to the Inspector of Agriculture, Sholapur, S. D. and the District Agricultural Overseer, Ahmednagar, S. C. D.

(60) *Second class seed.*—The production of second class seed during the year under report, *i.e.*, seed of the second generation off the farms, amounted to 363,260 lbs.

The following statement shows the sources of this supply :—

	lbs.
23 Registered Seed Growers	143,260
6 Seed Unions	176,000
2 Agricultural Associations	44,000
Total ..	363,260

This amount of seed will cover—with a seed rate of 16 lbs. to the acre—an area of nearly 22,700 acres and will mean increased profit to the growers of about Rs. 158,900, *i.e.*, Rs. 7 per acre increase of profit to growers of pure N. R. cotton as compared with local Khandesh mixture.

As the staff available for distribution is small and as funds were short, the Department repurchased for distribution only 61,851 lbs. of second class seed from registered seed-growers. The Agricultural Associations and Seed Unions producing second class seed arranged to distribute the same independently amongst their members and others. The remainder of the seed of the registered seed-growers was disposed of by them privately for seed purposes, in many cases with the help of the Department.

As indicated in a previous paragraph, the second class seed, purchased by the Department was distributed, not to private individuals, but to Agricultural Associations, Credit Societies and Co-operative Seed Societies in the hope that such bodies, by reason of their co-operative nature would prove more effective agents for the propagation and distribution of the seed than the individual cultivator could be. The following is the distribution list of this second class seed:—

Name of Society or Association supplied with second class seed.	Second class seed supplied.	Total.
	lbs.	lbs
Agricultural Associations—		
Raver	4,800	
Chopada	3,200	
Shirpur	1,600	
Bhusawal	3,000	
Erandol	400	13,000
Co-operative Seed Societies—		
Khadaki	1,600	
Bhadgaon	2,400	
Bildi	2,500	
Shendurni	1,600	
Dighave	4,000	12,100
Credit Societies—		
Bhusawal	1,440	
Nasik District	11,200	
Sindhkheda	3,200	
Shahada	2,300	18,140
Others (outside N. C. D.)	....	18,611
Grand Total		61,851

As in the case of the first class seed, more applications were received for second class seed than could be dealt with and even the quantities distributed had in most cases to be cut down below the amounts actually asked for.

If the above mentioned bodies maintain a fair purity in their crops and given a normal season, a good N. R. seed of the third generation off the farm should be available at the end of the ensuing year for an acreage of 61,000 acres.

(61) During the year under report, the Cotton Supervisor was deputed for a month to visit the Central Provinces and study the system of cotton seed organization in vogue there. His report has been received and endeavour will be made to introduce any improvements suitable to the North Central Division.

GENERAL.

(62) The formation of a Divisional Board, representing the Agricultural and Co-operative Departments, and including non-official members, to control the agricultural propaganda work in the Division, was a feature of the year under report.

(63) The introduction of the new scheme, already referred to, whereby it is hoped to enable local bodies to take a much more active part in the development of the areas they represent, has been successfully accomplished.

(64) Arising out of this latter scheme, the condition and constitution of the existing Agricultural Associations, have been the subject of much inquiry. In many cases it has been found that these depend too much on the personal influence of enthusiastic gentlemen and are not sufficiently organised to survive the withdrawal of their active interest, should circumstances necessitate it. In addition, many associations do not have an annual income derived from members' subscriptions but exist for a short time on the initial capital raised and finally become inoperative owing to lack of funds. A scheme has been drawn up, in which talukas are graded, chiefly on the standard of efficiency found in their local agricultural associations and a progressive plan of work has been outlined to place these bodies in a more efficient and effective position.

(65) It is an unfortunate fact that in this report dealing with a very progressive agricultural district, no mention can be made of the work of any institution for agricultural education. Owing to the present financial stringency, the establishment of the proposed agricultural school at Niphad has again been postponed. However the Dhulia Agricultural Association has put up proposals to Government for an agricultural school at Dhulia, where special facilities for such an institution exist. It is hoped that the enterprise of this Association will bear fruit in the near future and supply a long-felt want in providing facilities for the agricultural education of cultivators' sons in the Division.

(66) In addition to the remarks on the work of various members of the establishment included in the body of this report, the work done by Mr. T. V. Nagarshet, District Agricultural Overseer, West Khandesh, prior to his transfer and by Mr. N. V. Bhagwat, District Agricultural Overseer, Nasik, is worthy of mention. Both these officers have shown a good appreciation of the requirements of a district agricultural overseer.

Mr. B. P. Wagholkar's personal knowledge of Khandesh and his influence with the cultivators in that district, has been very marked and productive of good results.

In conclusion, I wish to express my appreciation of the work done by Mr. D. L. Joshi, Head Clerk, both in the original establishment of the new office at Nasik and in the conduct of the clerical work during the year.

WILLIAM J. JENKINS,

31st July 1922. Deputy Director of Agriculture, N. C. D., Nasik.

APPENDIX C.

SUMMARY OF WORK DONE BY THE DEPUTY DIRECTOR OF AGRICULTURE, SOUTH CENTRAL DIVISION, POONA, FOR THE YEAR 1921-22.

STAFF.

Mr. P. C. Patil, permanent Deputy Director of Agriculture being on study leave in America I held the charge of the office throughout the year. The old territorial charge of this Division was, during the year, divided into two, *viz.*, : North and South Central Divisions, the former having been taken over by Mr. Jenkins, the latter remained in my charge. It consists of the following four Districts, *viz.* : Poona, Ahmednagar, Satara and Sholapur. There was no change in the District or Farm Staff, except some of the members had gone on privilege leave for short periods. Mr. Kogekar, Divisional Superintendent of Agriculture, Central Division, was put on special duty for three months to make a detailed survey of the Khed Taluka in the Poona District with a view to find out its potentiality for organization of a Taluka Agricultural Association.

Mr. D. H. Tagare, who was acting as Divisional Superintendent of Agriculture, S. D., for over 5 years, had to revert to the senior grade of Graduate Overseers, owing to the difficulty to work in Kanaree Districts on account of (Kanarese) language. Mr. Tagare did the special survey of the Madha Taluka where a new Taluka Association has recently been established in accordance with the new scheme for development of agriculture with Local Organization of a Taluka as a unit.

SEASON.

The past agricultural season though not very good, was not, on the whole, a bad one. The monsoon commenced in June but the rain-fall was not sufficient to commence kharif sowings in all the places. In the Mavals, the sowings of rice for seedlings, was done in time, but for want of sufficient subsequent rains, their growth was checked. The transplanting of rice seedlings had, therefore, to be delayed till the beginning of August.

The sowings of the usual kharif crops, *viz.*, jowar, bajri, groundnut, cotton, etc., were done in July in the Districts of Poona, Nagar, Satara and Sholapur as the rains in July were of general nature and gave sufficient moisture for sowing purposes. The month of August went practically dry which had a very serious effect on the young crops. In the Sholapur District, the Cotton crop had to be grubbed up and the land resown with rabi jowar later. The rains in September were sufficient for the timely sowings of the Rabi crops, *viz.*, jowar, gram, wheat, etc. However, the later rains of October and November being scanty in some places, especially in parts of Poona and Ahmednagar Districts, the rabi yields in these parts did not turn out as expected in the beginning. These rains were favourable in Satara and Sholapur and the rabi crops there did well, the jowar crops in the Sholapur District, being exceptionally good in some parts.

The area under sugarcane excluding canal area, was reduced owing to scarcity of water in wells.

In the Sholapur District the plantations of citrus, betel vines and plantains suffered considerably for want of sufficient water in wells. Similarly the area under potatoes in the Khed Taluka was reduced for scarcity of water.

In the canal tracts of the Godavari and Pravara, the sowings of bajri and other kharif crops were done in time as usual. But these crops did not make good progress owing to the long drought during August. However, canal water became available in September which saved the crops to some extent. The crops on very light lands, were lost during the long drought. The sowings of rabi crops were done after the September rains as in other places, but as the subsequent rains failed, they had to be irrigated. The irrigated crops of wheat and gram were better than usual.

Owing to the damage from the attack of borer in the early stage the sugarcane crop did not come to maturity till late in March. The crushing had, therefore, to be prolonged and in some cases, it continued till June. The outturn of Gul was below average. A portion of the crop had to be kept as Adsali on the Godavari and Nira Canals. The Irrigation Department having permitted 3 months overlapping on the Godavari Canals, the plantation of new canes was not delayed. On the Nira Canal, the planting of new cane was somewhat late. The sugarcane crop under the Krishna Canal suffered more severely from borer attack than elsewhere. Some of the crop had to be grubbed up there.

The attack of Cock-Chaffer to rabi jowar in its early stage, was found to damage the crop to an appreciable extent. Similarly bajri, mug and udid were affected by caterpillars in the Poona and Ahmednagar Districts. The damage was not, however, very serious.

EXPERIMENTAL AND RESEARCH WORK.

Barmati Farm.

Sugarcane.—A series of experiments are laid out on this Farm to find out the exact requirements of water, manure and the interval between waterings, etc., under the conditions in the Nira Valley.

The land being in possession of a large number of different owners, its previous treatment was different from plot to plot. Hence the crop was uneven in certain plots though efforts are being made to equalize the condition of the plots by growing a common fodder crop in rotation. The results obtained in these series being only for the first year may not be conclusive.

The results as obtained are given below :—

(I) Irrigation Experiments—Interval series.

Quantity of water given.	Interval.	Manurial treatment.	Outturn of Gul per acre.	Remarks.
70 acre inches rainfall ..	8 days interval .. 10 days ,, .. 15 days ,, ..	20,000 lbs. dry matter in san and supplemented with Farm Yard Manure and a top dressing of 150 lbs. Nitrogen.	12,787 lbs. 9,188 ,, 7,610 ,,	In plot I only a part of the plot was harvested, the rest being used for seed purpose.

(II) Irrigation experiments quantity series.

Quantity.	Interval.	Manurial treatment.	Outturn of Gul per acre.
70 acre inches ..	The usual interval of 10 to 12 days as obtained by cultivators.	20,000 lbs. dry matter in san and supplemented with Farm Yard Manure and a top dressing of 150 lbs. Nitrogen.	8,018 lbs.
100 ,, ,, ..			10,132 ,,
125 ,, ,, ..			11,675 ,,

(III) Manure series (different quantities of Nitrogen applied as top dressing).

Manurial treatment.		Outturn of Gul per acre in lbs.	Remarks.
Before planting.	Top dressing.		
40,000 lbs. of dry matter in San and Farm Yard Manure.	150 lbs. Nitrogen .. 200 ,, ,, .. 250 ,, ,, ..	11,045 11,083 10,464	The plot with 250 lbs. Nitrogen being uneven the crop in portion was poor.

Note.—In these experiments (III) the quantity of water and the intervals were just the same as available for ordinary cultivators.

Among the valuable garden crops intended to be introduced as rotational crops, potatoes and cabbages have proved successful. But the local market is not suitable for these crops.

KOPARGAON FARM.

This Farm being situated in the heart of a large sugarcane tract, it is found extremely difficult to find sufficient quantity of Farm Yard Manure for sale. Price of Farm Yard Manure has gone as far as Rs. 4 per cartload. Thus a comparative experiment was tried with other available manures and the results show that Ammonium Sulphate could be given as a top dressing to Fodder crops with advantage :—

Serial No.	Area.		Manurial treatment per acre.		Yield per acre.			Remarks.
	Acre.	Guntha.	Kind.	Quantity.	Fodder (baled) in lbs.	Grain in lbs.	Bhusa in lbs.	
1	1	..	Sodium Nitrate ..	150 lbs.	3,175	660	91	
2	1	..	Sulphate of Ammonia ..	100 lbs.	3,837	649	117	
3	1	..	Safflower Cake ..	286 lbs.	3,197	495	76	
4	1	..	Farm Yard Manure ..	15 cartloads.	2,878	484	100	
5	1	..	No Manure ..	*Nil.*	2,734	319	65	
6	1	..	Sulphate of Ammonia ..	100 lbs.	3,710	495	95	Duplicate plots.
7	1	..	Safflower Cake ..	286 lbs.	2,901	440	92	
8	1	..	Farm Yard Manure ..	15 cartloads.	2,508	374	76	
9	1	..	No manure ..	*Nil.*	2,070	286	56	

A large quantity of fodder is supplied from this Farm in famine time, partly to cultivators and partly to Military Department and Officers of the several Departments. The quantity distributed since 1917-18 is given below for ready reference in future years :—

Year.	To whom supplied.	Where supplied.	Quantity of fodder supplied in lbs.	Remarks.
1917-18 ..	Military Department ..	Bombay ..	1,69,367	
		Poona ..	20,449	
		Kirkee ..	1,875	
			1,91,691	
1918-19 ..	Sugarcane Expert ..	Kopergaon ..	19,540	
	Famine Relief Committee ..	Nagar ..	95,000	
	Government Farms ..	Surat and Amalsad ..	2,03,305	
	Officers of the several Departments.	Kopargam and Dhulia ..	20,772	
			3,38,617	
1919-20 ..	Cultivators ..	Yeola and Kopargam Talukas.	34,455	
	Officers of the several Departments.	Kopargaon and Nagar ..	10,072	
			44,527	
1920-21 ..	Cultivators ..	Kopargaon taluka ..	2,32,045½	
	Do. ..	Sangamner ..	25,750	
	Cattle Camps ..	Kopargaon and Lakh ..	3,218	
	Officers of the several Departments.	Kopargaon, Nagar, Rahuri, Yeola, etc.	89,060	
			3,50,073½	
1921-22 ..	Cultivators ..	Kopargaon taluka ..	42,317	
	Officers of the several Departments.	Kopargaon, Sangamner, etc.	16,236	
	Cattle camp ..	Kopargaon ..	54,764	
			1,13,317	

The experimental work done on sugarcane on a small scale on this Farm was of great practical value to cultivators in the introduction of suitable varieties for the water-logged and salt areas under the Godavari Canal.

DEMONSTRATION WORK.

Canal Tract.—A good deal of progress on this line of work has been done by Mr. Athalye, the Divisional Superintendent of Agriculture, D. C., in the sugarcane tract under the Deccan Canals of which he is in charge. The work consists of introduction of improved methods of cultivation of sugarcane, introduction of new crops suitable to the tract, distribution of implements, demonstration of remedies against crop diseases and insect pests. All this work is done in cultivator's fields under the advice and supervision of the district staff which consists of Graduate Overseers and trained fieldmen and kamgars. With the help of these assistants Mr. Athalye has been able to arrange a large number of demonstration plots in cultivator's fields, *viz.*—

(1) 42 Plots for sugarcane crop.
(2) 12 Plots for groundnut crop.
(3) 2 Plots for turmeric crop.
(4) 1 Plot for tobacco crop.
(5) 6 Plots for wheat crop (Pussa No. 4 and 12).

The main points for demonstration on sugarcane were—

(1) Wider method of planting, *viz.*, 3½′ to 4′ apart to facilitate intertillage.
(2) Long rows in beds to facilitate interculturing and earthing up cane by bullock implements instead of hand-work.
(3) Reduction of seed from 14,000 sets to 10,000 sets.
(4) Planting sets with eyes sideways to ensure full germination.
(5) Use of Ammonium Sulphate as part of top-dressing to substitute safflower cake.

It is satisfactory to note that the improved methods are being taken up by the cultivators rapidly.

The trial of Manjav variety of cane at Velapur in water-logged lands and of Red Mauritius at Nimgaon in saltlands, have been of great immediate practical use to the sugarcane growers in the Gadavari valley. Cultivation of these varieties in such lands is extending.

The popularity of the Implement Depôts, managed by the Department, is seen by the large demand for ploughs both for sale and hire. The popularity of Ridging-plough is increasing both in the Canal tract and in the Sholapur District.

Sholapur District.—The demonstration work on the dry crop areas consists mainly of various iron-plough, chaff-cutters and hand hoes. The cotton and jowar crops, saved on the Mohol plot, through repeated hand hoeings, during long drought (when other cultivators had to grub their cotton crop) have aroused great interest among cultivators for this operation. It is believed that the method adopted would be popular in a short time.

The trial of top-dressing manures on spelt wheat tried at Arjunsondha, has given unexpectedly high yields. With the application of 4,521 lbs. of groundnut cake and 47 lbs. of Ammonium Sulphate, an yield of 2,833 lbs. of grain is obtained. It requires further trials before taking up for demonstration.

Poona and Ahmednagar Districts.—The demonstration of application of Ammonium Sulphate to stunted seedlings of rice crop to invigorate their growth for timely transplanting in Mulshi Peta of Poona district, was of practical value. Similarly the demonstration of sprayings, undertaken in all the districts is gaining popularity. Spraying or dusting Potatoes and Chillies for Tambera in the former and leaf-curl disease in the latter, was done on large scale in different parts, to the entire satisfaction of the crop-owners. Demand for dusting powder has increased. Similarly the spraying of lucerne for Aphis, and onions for Thrips, in the Poona and Ahmednagar districts saved the crops to such an extent that the operation seems to be taken up by the cultivators themselves.

Satara District.—The important work in the Satara district is the introduction of potatoes as unirrigated crop in the Canal areas in the kharif season, and in the Mal lands in the rabi season. The results so far have been encouraging. Lime-Sulphur dusting against Tambera was effective in the majority of cases where it was tried.

HIRE OF IMPLEMENTS.

The following statement gives details of hire collected during the year from the implements kept for hire at several implement depôts in charge of kamgars :—

Depôts in district.	No.	Amount of hire collected.	Remarks.
		Rs. a. p.	
Sholapur and Satara	1	147 8 0	The amount of hire including Khandesh districts was Rs. 2,929-6-9 during the last year.
Ahmednagar	5	938 6 0	
Poona	5	598 3 3	All worn-out implements were repaired during the year.
Canal-tract	9	1,423 3 0	
	20	3,107 4 3	

Credit is due to Messrs. Athalye and Gadgil for the proper organization of the depôts and of obtaining necessary spare parts in time. There is great scope for this work by non-agricultural co-operative societies.

DISTRIBUTION OF SEEDS, MANURE AND IMPLEMENTS.

The following statement shows the details of the work done in different districts in the Division and the help given to cultivators, in their timely obtaining the materials and at proper cost :—

Serial No.	District.	Seeds.		Manure.		Implements.	
		Quantity in lbs.	Value.	Quantity in lbs.	Value.	No.	Value.
			Rs. a. p.		Rs. a. p.		Rs. a. p.
1	Sholapur ..	788	121 2 6	6 Tons	2,130 0 0	14	1,488 0 0
2	Satara ..	694	41 15 3	*Nil.*	....	2	282 0 0
3	Ahmednagar ..	5,880	1,258 0 0	594	97 0 0	22	1,712 0 0
4	Poona ..	3,760	591 0 0	800	130 0 0	2	75 0 0
5	Canal tract ..	7,313	1,109 9 0	1,33,466	16,624 14 3	238	8,219 2 0
	Total ..		3,121 10 9	....	18,981 14 3		17,776 2 0

The number of Copper Sulphate packets distributed during the year was rather small. The difficulties in the extension of this important propaganda, as explained by the Divisional Superintendent of Agriculture, D. C., are—

(*a*) Copper Sulphate is a poison and cultivators still feel the danger of keeping and handling it.

(*b*) The damage by smut to rabi jowar is not strikingly large and certain every year.

However the work requires pushing on through several local agencies.

VERNACULAR AGRICULTURAL SCHOOL AT LONI.

The statement made last year, *viz.*, "The initial difficulty of securing boys for the Vernacular Agricultural School seems to have been overcome to a considerable degree" is corrobotated by the fact that the required maximum number of boys have joined the school without any special efforts for recruitment.

The annual examination was conducted jointly by Mr. Pawar, Inspector of Agricultural Schools, and Mr. Gadgil, District Agricultural Overseer, Ahmednagar. Out of the total number of 46 boys examined 44 were successful. Credit is due to the Head Master Mr. Khandekar and the staff under him.

General management.—With proper supervision and advice, the expenditure under Boarding is gradually being decreased and the income in farm produce increased. This will be seen from the following statement :—

Year.	Cost of Boarding per head per month.	Produce grown on the Farm worth	Actual amounts credited into Treasury.
	Rs. a. p.	Rs. a. p.	Rs. a. p.
1919-20	17 0 0	2,005 0 0	373 0 0
1920-21	15 11 6	2,631 5 3	381 10 11
1921-22	13 6 0	2,793 14 3	570 4 0

There is great scope for increasing the crop-produce on the Farm.

27 students attended the 1st year's course and 22, the second. Out of the total number of 49 students, 16 were Brahmins, 19 Marathas and 14 other non-Brahmins.

Poultry breeding is taught as a secondary occupation. It is intended to take up Gudar weaving also shortly.

Agricultural Associations.—These are progressing fairly well under the general guidance of the Divisional Superintendent of Agriculture, D. C., on the Godavari and Pravara tracts, and of Mr. Jadhav at Baramati on the Nira valley.

Taluka Development Associations.—Under the new scheme of Government, it is intended to start these associations in talukas which are ripe to take up the propaganda work for themselves. A preliminary survey of such talukas is made before starting the Association. The Madha Taluka in Sholapur District being found ready in all respects, an association was started there during the year and the services of a trained Overseer temporarily lent, till a new man is trained for the association. The progress made by this association is watched with great interest.

Contributions to Agricultural Magazine.—The district staff has supplied during the year under report material for publication in the *Shetki and Shetakari* and also as Departmental bulletin. Mr. Athalye's contribution is worthy of mention.

Staff.—The staff as a whole has now gained sufficient experience as to how to approach the cultivators and to introduce the known improvements in their fields. Mr. Bhandarkar's work has been found to be satisfactory throughout the year.

AGRICULTURAL IMPROVEMENTS ADOPTED BY CULTIVATORS.

The agricultural improvements adopted by cultivators are in two ways both of which tend to increase their net income, *viz.*—

(1) By increase in the yield of crops.

(2) By decrease in the cost of crop production.

Increase in the yield of crop is effected—

(*a*) by better cultivation with improved agricultural implements such as ploughs, ridgers, hoes, etc. ;

(*b*) by growing new varieties of crops such as sugarcane varieties, selected types of cottons, new varities of groundnuts, etc. ;

(*c*) by adopting remedies to stop crop diseases and insect pests such as Smut in Jowar, Tambera in potatoes, Makoda in chillies, Mildew in grapes, Aphis on lucerne and Thrips on onions ;

(*d*) by use of newly introduced artificial manures such as Ammonium Sulphate and different oil cakes for sugarcane and several other crops.

Decrease in the cost of production is effected—

(*a*) by adoption of bullock labour implements where hand labour was used (especially in sugarcane cultivation, *viz.*, earthing up and interculturing);

(*b*) by introduction of iron ploughs for removing deep rooted weeds like Hariali and Kunda while that operation was done by hand a few years ago at more than double the cost;

(*c*) by introduction of big and small machineries such as sugarcane mills, stone-rollers, threshing machines, which do the work at a much smaller cost than the old methods and give better outturns.

(*d*) by the adoption of improved furnace which has reduced the cost of fuel in the manufacture of gul;

(*e*) by reduction of seed as in sugarcane.

To add to the above a great deal of wastage of fodder is stopped by the use of circular hand-power chaff-cutters. This wastage would further be reduced by the introduction of power chaff-cutter.

It is extremely difficult to estimate the exact amount of profit in money realized by the cultivators by the adoption of agricultural improvements introduced during the last 15 to 20 years. However, it is certain that the benefit to cultivators through these medium of improvements, in the South Central Division, has been very great.

The note prepared by the Divisional Superintendent of Agriculture, D. C., gives more details on this subject. Mr. Athalye has attempted to make a rough estimate of the benefits in money value. It may be published as an accompaniment to this summary.

Poona, 25th August 1922.

M. L. KULKARNI,
Acting Deputy Director of Agriculture,
South Central Division.

APPENDIX D.

ADMINISTRATION REPORT AND SUMMARY OF WORK BY THE DEPUTY DIRECTOR OF AGRICULTURE, SOUTHERN DIVISION, DHARWAR.

A.—GENERAL.

1. The year under review completes a period of 18 months, ending May 31st, during which I have held continuous charge of the office of Deputy Director of Agriculture, Southern Division. The Division now includes only Belgaum, Bijapur and Dharwar Districts, and the work in Sholapur and Satara, which I discussed in my last report, has been transferred to the charge of the Deputy Director of Agriculture, South Central Division. Last year I was able to view the work impartially, as, except for six months in 1919-1920, I had only just returned to my post after four years' absence. This year, I shall try to give a general impression of the stage at which the work here stands, and shall also give a prominent place to criticism of lines of development which can be followed up with profit. I must ask to be excused for writing more than a simple report of work done.

B.—STAFF AND ORGANIZATION.

2. The same principle of organization in sections, each responsible through its head to the Deputy Director, has been maintained. The Divisional Superintendent's section comprises two districts—Dharwar and Belgaum, and his superior staff number two fieldmen, graduates of the Poona Agricultural College, and two non-graduate fieldmen. Bijapur District is staffed by one non-graduate directly responsible to the Deputy Director, and by one temporarily allotted to the Cotton Superintendent's staff. The Cotton Superintendent's post was gazetted as a Provincial post during the year, and two graduates have been appointed to assist him, out of the three sanctioned. The farm sections remain as before—the cotton breeder's post has been gazetted, and his graduate staff have been appointed.

3. The realisation that Agricultural improvement cannot spread far or quickly without organization of the people's resources, and of effort by them, has led to the establishment by Government of Divisional Boards of Agriculture. The Divisional heads of the Co-operative and Agricultural Departments are to meet non-official representatives of the agricultural resource movement, and discuss their work. These Boards will, amongst other duties, control Taluka Development Associations. The Board did not operate during the year under report, but the working out of details under the scheme has occupied a good deal of my attention.

4. There is no question that without a scheme of work which enables technical improvement to go hand in hand with organization of resources, little advance can be made. The Agricultural Department has worked out, and is working out, definite improvements in practice, but the majority of them involve increased outlay for increased profits, in fact they are often not improvements for the small man, because his business as it is will not stand an extra capital charge : but given organization of the cultivators' resources amongst themselves, and the development of agricultural supply business—implement hiring, seed supply,—the outlook for the small man changes entirely.

5. Demonstration work during the year was done largely in consultation with the Co-operative Department. Guaranteeing Unions took a prominent part in their organization, and Honorary Organisers, landlords and Revenue Officers gave a deal of help.

6. A meeting of the staff was held to discuss the work in the different sections, and a resolution was passed appointing a publication committee, whose first duty shall be to publish a Divisional Year Book, and who shall also undertake to collect and analyse information on the Agricultural Geography of the Division, from reports and diaries which have accumulated. The first aims at being an annual record of progress, more readily readable by the non-agricultural public man and by the educated farmer, than is the more formal annual report. The second is a necessary preliminary to the extended organization of propaganda through local bodies ; and its general utility, in order to avoid repetition of work, is obvious.

C.—EXPERIMENTAL WORK.

7. Last year I reviewed briefly the work of the Dharwar Experimental Station. It was largely a record of negative results, but though the negative result is disappointing to the experimenter, and to the tax-payer, it relates to work which had to be done in establishing the pros and cons of various agricultural practices, and it is more than satisfactory to have this work behind us. This farm has given us however some very valuable positive information which forms the basis of the demonstrator's work. It has determined ploughs suitable for different soil conditions, and has been a prominent unit in establishing the implement hiring business. It has determined the great possibilities for the conservation of the products of scavenging as nightsoil and poudrette. It has determined as result of 12 years' experiment, and at the prices of manure and produce current during these years, that at least 5 tons of farm manure are needed by black soil once in two years to yield a profitable crop, and that 10 tons can be applied every second year with still greater profit. It has given us valuable varieties of cotton. It has shown us a practicable, efficient and cheap method of preventing surface

erosion, under the physical conditions of the farm area. It has imitated the copper sulphate treatment of jowar seed to prevent smut, and methods of fruit tree propagation, as worked out at other stations, and has found them successful.

8. Mr. Shevade, as Superintendent of the farm gives in his annual report careful summaries of some of the past experimental work, and describes the current work. The principal new feature is concentration on improvement of the jowar crop. Analysis of varieties as grown by cultivators showed that Fulgar Yellow grown from farm seed was quite pure, and that out of 10 samples of cultivators' seed of miscellaneous varieties two were quite pure, as named, five were of 99—96% purity, and the rest very impure. It is probable that the very impure samples were deliberate mixtures, as mixing of varieties is a common practice. The other figures are important to the plant breeder, indicating as they do, that under field conditions, with possibility of cross fertilisation from neighbouring fields, varieties can be kept pure. Mr. R. K. Kulkarni, working under the guidance of Mr. G. L. Kottur, devotes his whole attention to jowars, and has made a close study of many local varieties, and is well on the way to establishing pure lines to form the basis of cross fertilisation work. These two officers have sent a preliminary account of some of the work on jowar to the Agricultural Journal of India, and their article has been accepted for publication. I do not wish it to be understood from these remarks that the improvement of the jowar crop has not been attempted in past years, but our method has hitherto been wrong. Now with a whole time specialist on the job, there is no reason why jowar breeding should not give as far reaching results as has cotton breeding, which has for many years occupied a whole-time man.

9. Trial of implements has during the year shown us a small threshing machine, which while useless for wheat, has a possible future for rice. This is a line of work in which financial stringency is handicapping us considerably, and the handicap ought to be removed as a false line of economy.

10. The Cotton Breeder Mr. Kottur reports further progress in selection from the offspring of the cross Dharwar No. 1 by Rosea, which has reached its fourth generation. His studies on this cross are directed partly to the immediate establishment of a fixed strain of economic value, and partly to the study of the theory of inheritance as applied to cotton breeding. He is also studying pure lines, and crosses of other cottons. Twenty-two American varieties were imported, and tried at Gadag—most showed variation in some characters ; some may come in useful in future for cross breeding work.

11. A careful study of wilt of cotton, is being made in collaboration with the Plant Pathologist.

12. The Gokak farm also has much to record of negative trial. I think that perhaps its most striking positive result to those who knew it several years ago, in the wonderful improvement effected by good cultivation, and by doing what any cultivator in a similar locality can do in his spare time :—draining of alkali land, carting nala silt, and levelling and embanking. Mr. Swadi, former Superintendent of the farm, has just completed an account of the past work of this farm. Mr. Neginhal's, the present Superintendent's, annual report is the report of a man who has his eyes wide open in the field, and who studies the cultivators' business. The farm has contributed to the study of the manurial problem, has shown the value of using a non-sticky earth as an absorbant of urine in the cattle byre, and has shown the value of sugarcane, trash, green manures, and the proper quantity of artificials for irrigated crops. It has proved the advantage of wider planting of sugarcane. It has contributed to the study of useful cultural implements, and of protection of crops against wild animals. It has worked out much in orchard management. The value of the results of this farm are I think proved over and over again by the facts that during the year :—20 bags of ammonium sulphate, and about 300 bags of cake were sold. Many surrounding cultivators are using an iron plough both for ordinary work and for burying green manure. Many are planting their sugarcane wider apart. Three small fruit gardens were established. Many enquiries about cultural methods of sugarcane and destruction of cattle ticks were received. Exclusive of neighbours who frequently visit the farm, and of men who were specially invited to attend a demonstration, one thousand cultivators visited the farm.

13. The current experimental work follows up and develops earlier comparative experiment on cultural methods and manures, is working out a system of slow irrigation for the orchard, and is studying rotations, and new crops. One of the biggest causes of inefficiency in irrigated farming, especially where water has to be lifted by the cultivator himself, is loss through leaky water channels. This point is being carefully studied. A concrete channel at a cost of 5½ annas per foot has been built, and has yet to show itself efficient or otherwise in the long run.

14. The experimental work of the Tegur farm is well on the way to establishing an improved herd of cattle which can be bred in the Mallad, has taught us a good deal about cattle, and cattle farm management, and is studying the improvement of grazing. Apart from cattle, the country offers big possibilities for sheep breeding.

15. Experimental work is carried on in cultivator's fields, to test the application of farm results to other localities.

16. Comparative trials of Gadag No. 1 and Dharwar American cotton were made in two places, and the relative periods of growth studied. Gadag No. 1 is later, in that the majority of the crop is ready for picking 9 days after Dharwar American, though they both fall due for final picking about the same date. The year was very exceptional; cotton was sown very late, and red leaf blight did not appear on the ordinary American crop, the result being that for the first time on record, the ordinary crop has beaten the selected. I look on this as the exception which proves the rule.

17. Trials of Dharwar No. 1 against Kumpta cotton, have confirmed last year's results that it is a marked improvement at Aminbhavi, Haveri and Shiggaon, and also in parts of the Bijapur District.

18. Experiments relating to the culture and manure of sugarcane were conducted at 25 places. Yields were not measured, but the advantages of the novelties introduced were obvious to the eye.

Cake manure for the paddy crop was tried at 9 places, and proved its value in 8 out of the nine. Cake and Sodium Nitrate were tried for chillies at 8 places, and results measured at one place, with figures in favour of cake. Surface drainage schemes of gardens have been laid out at Devi-hosur and at Kittur with marked advantage.

D.—PROPAGANDA WORK AND SERVICES TO THE PUBLIC.

19. This work follows on the results obtained on the experimental farms, and is done partly by the farms themselves, and partly by the District travelling staff, and in ever increasing proportion, through the agency of co-operative organisation, and private enterprize. A part of the Gokak farm's work under this head has already been indicated, when discussing its experimental results. This farm has also during the year supplied experts in gul-making, and has met a fair demand for sugarcane seed sets, and seed of various kinds. The Dharwar farm, supplemented by the Gadag farm has maintained the basic supply of pure seed of Dharwar No. 1 and Gadag No. 1 cottons, has supplied seed of other crops and young fruit trees, has supplied implements, and carried out repairs for cultivators. Gokak farm held a general demonstration during the year. Mr. Salimath, Acting Divisional Superintendent, describes 34 demonstrations in the Dharwar District, and 20 in Belgaum District. At each place the demonstration continued for about a week, and he and his staff had a busy cold weather season. Eleven demonstrations were held in Bijapur District. In future the Divisional Board, and it is hoped the Taluka Development Associations will take a prominent part in this class of work.

20. Mr. Dharwarkar, Cotton Superintendent, gives a detailed report of a busy cotton season, arranging for seed production with seed growers, and for grading and sale of produce, and for extensive seed supply through the agency of Co-operative Sale Societies. Seed of Dharwar No. 1, Gadag No. 1 and Dharwar No. 3 cottons, sufficient to sow about 70,000 acres, was sold. Pure seed available to meet our guarantee during the coming season is sufficient for 6,400 acres of Dharwar No. 1, and 7,000 acres of Gadag No. 1, which is well over our guaranteed minimum. Other seed of these varieties purchased by societies is enough for 60,000 acres. The organisation for seed supply, which I worked out in consultation with the Cotton staff in 1919, depending on the annual production of self-fertilised seed on the Dharwar farm, and following its produce up till the 5th generation will be in full operation from next year onwards. I did not, and do not feel that we can guarantee purity beyond the 5th generation, but had hoped that the 400 acre Gadag seed farm would make it possible to guarantee purity for another generation, and so enormously increase the amount guaranteed. However this farm, after a few months' life, has been abandoned.

21. Nearly 22,000 dokras of selected cottons were handled by Societies, by the Dharwar Agricultural Association, and by the Department, and prices realised represent over Rs. 1½ lakhs advantage over ordinary varieties.

E.—AGRICULTURAL SCHOOL, DEVI-HOSUR.

22. This school continues to prosper under Mr. Hulkoti's headmastership, but there is a growing feeling, critical of its real value. It has passed out 79 boys during its 8 years' existence, but only 25 are directly engaged in field work. The question is, what is the likelihood of creating a demand for the type of education we are giving. We aim at educating the farmer, and I am doubtful whether a system combining theory and practice of agriculture in a long course, which—at any rate in the Colonies—really appeals to the town-bred boy who wishes to go on the land, will find a prominent place in rural education here. Farmer's sons who want to learn something of the theory underlying their business may in the future come forward. Let them have this class of instruction, but do not waste their time by including in the course a lot of practical work which they have been brought up to all their lives. A much more probable demand by the farmer in the near future, is for short courses in definite technical improvements worked out at the experimental farms. A very big stumbling block to the extension of the present system is that a cultivator's son has finished his primary schooling several years before he is old enough, or strong enough to take up our course, and he does not want to go back to school. The result is that the complement of students is largely made up from the non-agricultural classes, or from agricultural classes engaged in trade, who use the education obtained for purposes other than developing farming.

F.—MISCELLANEOUS WORK AND STUDIES.

23. Mr. Salimath is studying cattle breeding in relation to fodder supply, tobacco cultivation, curing, and marketting, chilly marketting at Byadgi, grass varieties in the Mallad; in collaboration with the Dharwar farm, jowar varieties, and in collaboration with myself, the prospects for enclosure. Other officers are engaged in various studies connected with their special jobs, or with the experimental work of their farms.

24. I spent several months on tour, inspecting farms, and studying local farming, and am convinced that there are two problems whose solution will make a big mark in this part of the country. Enclosure in the Mallad is one—a co-operative village enclosure is already in existence—prevention of erosion in the black soil country is the other. I have made many enquiries with reference to the need, or possibility of providing the cultivator with a subsidiary cottage industry, and I am convinced that he does not want it. The man whose farming is in a sound position ought to, and can have his time fully occupied farming, and the man who is in a less fortunate position needs a rent act, or consolidation of his holding, so that he can spend his spare time on land improvement. In any case if a farmer wants more work, let it be an extension of his farming enterprise. A very notable feature in the spread of the iron plough, is that in localities where its value has been accepted, one village often has many in use, and a neighbouring village, apparently exactly similar in its economic position, has none. I can only account for this by lack of enterprise, which can only be awakened by intensive propaganda, both by Government working through local organisation, and by the implement firms themselves. I have during the year submitted reports protesting against the account system, which requires submission of a complete copy of every detail in the cash accounts, which does not allow the local administrative officer to spend money as he thinks fit within one unit of his work, and which does not represent to those who finally pass the budget, estimates for the natural units into which to the local officer groups the work. I mean I want an experimental farm recognised as a unit to be maintained or abandoned, and not the grant for, say, manure treated as a whole for Bombay Presidency, and curtailed to the detriment of work on all farms.

25. The expenditure in my division was Rs. 1,46,440 and the receipts Rs. 32,060.

26. Generally the staff have worked well, but agitations for more pay, and a general feeling of instability in organisation, and uncertainty in the future, have perhaps tended to make us pay too much attention to reforming methods, and too little to forming. But this is a phase which is rapidly passing.

T. GILBERT,
Deputy Director of Agriculture,
S. D., Dharwar.

APPENDIX E.

SUMMARY OF THE WORK DONE BY THE DEPUTY DIRECTOR OF AGRICULTURE, GUJARAT, SURAT, FOR THE YEAR 1921-22.

STAFF.

I held charge of the office of the Deputy Director of Agriculture, Gujarat Division, throughout the year.

Mr. G. N. Desai continued to work as Divisional Superintendent of Agriculture, N. D., for the whole year, except for a month from 15th September 1921 to 15th October 1921, when he was on privilege leave, during which period Mr. K. B. Naik, Superintendent, Surat Farm, acted as Divisional Superintendent. The temporary post of the Cotton Superintendent was made permanent from 10th June 1921 and the temporary man Mr. K. D. Naik continued to hold it till the permanent incumbent Mr. C. S. Patel returned from foreign service and took over charge from him on 17th August 1921.

Two new gazetted posts of Cotton Breeders one for North and the other for South Gujarat were also created from 10th June 1921, and were held by Messrs. D. P. Mankad and M. L. Patel from 17th August 1921 and 10th June 1921 respectively.

In addition to this a temporary establishment consisting of Mr. K. D. Naik as Assistant Cotton Superintendent assisted by one graduate and one non-graduate fieldman, was maintained for five months from January to May 1922 to assist the permanent cotton staff in collecting more cotton seed for distribution.

A good increase of five new permanent graduate assistants, three under the Cotton Superintendent and two under the Cotton Breeder, South Gujarat, was made during the year in addition to the permanent graduate staff of this Division.

The Department regrets very much to have to record the death of Mr. S. H. Pandya who worked as a Head Clerk for nearly 20 years in the Department under several Deputy Directors of Agriculture with unfailing zeal, energy and sense of duty and it is very doubtful whether his loss will be made good in the near future.

2. *Season.*—The monsoon burst in nearly the whole of Gujarat was very late after the middle of July and it continued to rain till the 3rd week in September without any appreciable break. Cotton had to be sown several times. Similarly crops requiring less rain, *e. g.*, bajri, maize, tilli and inferior millets, suffered from continuous rains. The distribution was uneven. It was heavy in July and was light but continuous in August and September. People could not get any time for interculturing and weeding and when the rains stopped, they stopped all at once, so that they had no time left for good after-tillage.

The yields of many of the important crops except rice was below the average ranging between 8 to 10 annas and kharif season on the whole may be said to be unfavourable.

As for Rabi sowings, those who could well afford to secure labour and bullocks and prepare the lands in time for sowing the rabi crops did fairly well and it was not so bad as the kharif one.

I.—EXPERIMENTAL AND RESEARCH WORK.

(*1*) *Cotton Breeding Branch.*

3. The whole of the cotton area of the Surat Farm was sown with the seed propagated from a single plant of Selection I-A. Long Boll Type. The seed propagated from a single plant becomes sufficient for growing the whole of the cotton area of the Farm after the third generation. The whole Farm cotton crop of Selection I-A. Long Boll Type was examined after the bolls were fully developed and rogues to the extent of one per cent. were weeded out.

The pure seed of this type of cotton thus obtained was distributed and grown by the Athwa group villages. The resulting cotton fetched in the first auction sale practically the same premium as that of 1027 A.L.F. grown in the Mohni group.

From a commercial point of view Selection I-A. Long Boll Type pays a little better to the cultivator owing to its higher ginning percentage than 1027 A.L.F., but on account of the better staple and silkiness of the latter, the trade demand is only for the latter. The local cotton committee has also resolved to push forth the latter and as it will be easy and advisable to have only one type in a tract, and in view of the increasing shortage of superior stapled cottons which also fetch better prices, it has been decided to grow henceforth the strain of 1027 A.L.F. In the boll stage this strain could be easily recognised from the rest. The whole of the Farm cotton area will be grown with this strain for securing seed for distribution in the Athwa group next season.

4. This strain was grown last year on 520 acres in the southern part of the Surat District. This year it will be on about 2,000 acres in the District. The two promising strains were compared with the two local cottons in separate plots with the following results :—

Variety of Cotton.	Yield of kapas per acre in lbs.	Ginning outturn.	Valuation per Khandi of 784 lbs. by Mill Owner's Association, Bombay.
Surti Deshi	309·9	34·7	
Selection I-A. Long Boll Type ..	490·3	37·5	Rs. 70 more than Surti Deshi.
1027 A. L. F.	471·9	36·0	Do.
Navsari Local		34·6	Rs. 40 more than Surti Deshi.

From the above it will be seen that both the strains are superior to the local cottons.

5. Unit selection in two strains of local cottons, in two strains of Selection I-A., in four strains of 1027 A.L.F., and in one strain of 1018 P-G was continued.

These above strains are being maintained on account of their direct or indirect useful characters and which may either be useful in this or in any other tract for further propagation or crossing work.

These strains being very pure also furnish very valuable material for the investigation of the (*a*) causes of low yield and (*b*) conditions affecting the production of good staple and high ginning percentage.

The results of such investigations of the last three seasons are being compiled in the second part of the Pusa Memoirs, Botanical series, almost on the same lines as those of first part dealing with Goghari cottons already published.

6. With a view to find out a strain superior to any yet discovered, the crosses made between pure bred strains in 1919-20 have reached the second generation. So far, the results are encouraging and they are being systematically worked out.

BREEDING WORK ON THE BROACH FARM.

7. Efforts are being made to acclimatise and further improve upon Selection I-A. Cylindrical Boll Type imported from the Surat Farm. This is a very bushy and heavy yielding type and was sown on the whole cotton area of the Broach Farm for securing seed for distribution. It was also grown on a large area in the District.

This variety did well in comparison with the Deshi in point of yield and quality, but fell short in ginning percentage due to disproportionate increase in seed-weight as compared to lint-weight.

On account of very bad attack of wilt this year it is not advisable to tabulate the yield figures of comparative plots of Selection I-A. and Broach Deshi.

The results of ginning outturn and valuations are tabulated below :—

Variety of Cotton.	Ginning outturn.	Valuations per Khandi of 784 lbs. by Mill Owners' Association, Bombay.
Purified Broach Deshi ..	35·7	
Selection I-A. Cylindrical Boll Type ..	34·8	Rs. 80 more than purified Broach Deshi.

Thus looking from the pecuniary point of view the improved type is better than purified Broach Deshi.

8. Last year, four plants were kept up for unit selection out of the selections of Broach Deshi with the object of segregating a strain having all the desirable characters, in case Selection I-A. Long Boll Type falls short of any expected character. All of them are inferior in staple to Selection I-A. but each of them has important economic characters. Some of them are found to be more wilt-resistant than the Selection I-A.

COTTON WORK ON THE DOHAD FARM.

9. Experiments for finding out a suitable variety of cotton for the Eastern Mahals of the Panch Mahals District are being conducted since long. Owing to the prevalence of frost in the latter part of December, only the Khandesh cotton variety can be successfully grown. It now remains to be settled whether such an inferior cotton is worth-while being pushed in such a small tract of Gujarat as against the double cropping area of the part.

COTTON BREEDING WORK IN NORTH GUJARAT.

10. In this tract Wagad cotton (a variety of Herbacium cottons) is very largely grown. In order to improve upon the local variety, the work of segregating pure strains from the local Wagad which is a mixture of several types, was originally started in the year 1917-18 on the Broach Farm and continued there till the year under report. During this year a plot was secured at Shella near Sanand of Ahmedabad District and the strains from Broach were transferred there. They were looked after by Mr. M. L. Patel, the Cotton Breeder, South Gujarat, till the appointment of Mr. D. P. Mankad, Cotton Breeder, North Gujarat, who was stationed on the plot. This site was found to be unsuitable specially due to the attacks of whiteants on selected plants and hence it was shifted to Viramgam in the current season.

11. In the 5 uniform and important strains, the economic characters observed at Broach were kept under observation with the following results :—

(*a*) Wagad white flowered.—It maintained the character of the flowers, though this character has no relation with the length of the staple, while it stands second in valuation and has the lowest ginning percentage.

(*b*) Wagad plant No. 4.—This is a big bolled type with a greater percentage of 4 celled bolls. It has got the longest staple of all with a fairly good ginning percentage of lint.

(*c*) Wagad plant No. 8.—This has got strong fruiting branches and a high ginning percentage of lint.

(*d*) Wagad plant No. 12.—This has got the highest ginning percentage of lint amongst all the strains.

(*e*) Wagad plant No. 14.—This has got a spreading habit a growth with small bolls.

12. With a view to compare this strains with the best types of Wagad cotton, seeds from renowned localities growing Wagad cottons were collected and grown. On comparison, all these were found to contain a mixture of Lalio, Rozi, Goghari, Cambodia and Neglectum cottons. Further progress as regards North Gujarat cotton is very carefully watched at Viramgam.

13. (2) *District Cotton Work.*—There has been no change in the policy as regards the improvement of cotton in the Surat District except that nearly 9,898 acres 13 gunthas instead of 7,231 acres were under Departmental control in six groups of villages. Of the total area of 9,898-13 acres the area under Selection I-A. and 1027 A.L.F. was 5,798-38 and 4,099-15 acres respectively. The latter area includes 520 acres under the special strain of 1027 A.L.F.

14. *Surat Cotton Committee.*—During the year 5 meetings of the local Cotton Committee were held. Below are given the dates and the summary of the work done at each meeting :—

No.	Date of Meeting.	Work done.
1	8th September 1921 ..	Submission of the Annual Report for 1920-21, and discussion regarding the collection of 2nd hand seed.
2	15th November 1921 ..	Discussion regarding the marketing of kapas and settling the extension of 1027 A. L. F. upto the river Narmada, when seed becomes available in sufficient quantity.
3	28th January 1922 ..	Fixing of rate of interest for advance money and ginning charges.
4	28th March 1922 ..	Settling the question of pressing bales in gins which have got presses of their own.
5	5th April 1922 ..	Question of distribution of seed of 1027 A. L. F., upto Narmada during the current season.

15. *Collection and Disposal of Cotton.*—Out of the six groups, cultivators from three villages of the Bardoli group and from all villages of the newly formed Ankleshwar group could not agree to gin their kapas with the other groups' cultivators, the former on account of their being pucca non-co-operators and the latter on account of want of confidence amongst themselves, as the Mamlatdar Mr. Keshavlal who was their guiding spirit was transferred from Ankleshwar just at the time of ginning. However, arrangements were made both with these cultivators and the ginners to whom they sold their kapas to keep the kapas separate and gin it separately and keep the resulting seed separate for distribution by them. About 50,000 lbs. of seed thus secured was all distributed by the gin owners concerned.

16. For the rest of the groups the following gins were selected by the cultivators with the approval of the Director of Agriculture :—

(1) Kapadia gin, Surat.
(2) Tata gin, Navsari.
(3) Messrs. Dahyabhai Ukabhai and Co.'s gin, Sisodra.

17. The total quantity of kapas ginned at these centres amounted to 27,970 maunds and 11 seers. The quantity of cotton (lint) obtained from this came to about 552 khandis. This was sold by auction in 11 lots as shown in the following statement :—

Auction Sales.

Date.	Name of group.	Quantity auctioned in khandies.	Name of purchaser.	Per Khandi.		Premium obtained.	Remarks.
				Rate obtained.	Local rate.		
19th March 1922.	Vijalpur ..	20	Mr. Ghelabhai Paragji.	573	505	68	Special Strain of 1027 A.L. F.
28th March 1922.	Athwa group ..	64	Mr. J. N. Kapadia.	545	515	30	Selection I-A.
28th March 1922.	Vijalpur ..	41	Messrs. N. R. & Co.	573	540	33	1027 A. L. F. and Special Strain.
28th March 1922.	Mohani ..	49	Do.	560	530	30	Do. General.
8th March 1922.	Supa and Sisodra.	76	Sheth Gangji Pitamber.	568	540	28	1027 A. L. F.
28th March 1922.	Nizer ..	41	Mr. Gandhi of Thakersy Mulji.	557	530	27	Do.
8th April 1922.	Supa and Sisodra.	34	Sheth Gangji Pitamber.	613	590	23	Do.
12th April 1922.	Vijalpur ..	15	Mr. Ghelabhai Paragji.	601	576	25	Do.
10th May 1922.	Mohani Khambhasla.	48	Messrs. N. R. and Co.	587-4	560	27-4	Do.
10th May 1922.	Supa and Sisodra.	56	Mr. Gangji Pitamber.	590	565	25	Do.
17th May 1922.	Athwa group ..	108	Mr. J. N. Kapadia.	565	540	25	Selection I-A.

From the statement it will be seen that the premium obtained for 1027 A.L.F. was uniformly good and it has been now decided to extend its cultivation upto Narmada River.

18. The details of the quantity of kapas, lint, value of seed, etc., are given in the following statement :—

Statement showing the details of Cotton, Lint and Seed, etc., during the year 1921-22.

No. of Lots.	Name of Group.	Area.	Quantity of Seed Cotton received and ginned.	Quantity of Lint obtained.	Quantity of seed obtained.	Rate of Lint per Candy of 21 Maunds.	Value of Lint.	Value of Seed.	Total Value.	Ginning and other charges.	Net Value.	Reduced Rate per "Bhar" of 24 Maunds.	Local Rate per Bhar of 24 Maunds.	Percentage increase over Local Rate.	Quantity of Kapas required to get one candy of Lint.	Ginning percentage.	Remarks.
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
		A. g.	Mds. Srs.	Mds. Srs.	Mds. Srs.	Rs.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs.				
I ..	Vijalpur Group .	372 1	1,206 17	C. M. Srs. (20 -4½-4¾) 425 2	781 15	573	11,544 10 3	1,823 3 3	13,367 13 6	473 11 0	12,894 2 6	256 9 0	215·	20·7	59·5	35·2	
II ..	Do. ..	..	2,589 20	C. M. Srs. (41½- ½-6) 866 27	1,722 33	573	23,539 12 0	4,019 14 9	27,559 10 9	965 4 0	26,594 6 9	246 8 0	225·	9·5	62·7	33·4	
III ..	Do. ..	..	910 37	C. M. Srs. (14½-4 -3½) 309 34	601 3	601	8,788 4 0	1,402 8 3	10,190 12 3	312 13 0	9,877 15 3	259 15 0	245·	6·1	61·7	34·0	
IV ..	Supa Sisodra Group.	1,566 20	2,314 0	C. M. Srs. (36½-4 -1½) 771 4	1,542 36	568	20,768 7 9	3,600 3 0	24,368 10 9	906 6 3	23,462 4 6	243 2 0	225·	8·1	62·9	33·3	
V ..	Do. ..	..	2,136 4	C. M. Srs. (33¾-1½-9½) 711 17	1,424 27	613	20,660 15 9	3,324 6 9	23,985 6 6	752 1 0	23,233 5 6	261 1 0	252·	3·6	63·1	33·2	
VI ..	Do.	..	3,623 13	C. M. Srs. (56½-4-29) 1,187 0	2,436 13	590	33,179 6 6	5,278 11 3	38,458 1 9	1,349 9 0	37,108 8 9	245 12 0	238·	3·2	64·1	32·7	
VII ..	Mohani Khambhasla Group.	800 27	3,030 30	C. M. Srs. (49¼-0 -4½) 1,034 14½	1,996 15½	560	27,453 13 9	4,591 11 0	32,045 8 9	1,232 7 0	30,813 1 9	243 14 0	225·	8·4	61·50	34·1	
VIII ..	Do. ..	..	2,993 24	C. M. Srs. (47¾-2½-5) 1,005 10	1,988 14	587	27,987 14 3	4,191 9 3	32,179 7 6	1,222 1 9	30,957 5 9	248 2 0	238·	4·2	62·50	33·5	
IX ..	Athwa Group ..	1,279 20	3,923 32	C. M. Srs. (64¼-4½-1½) (3 -4½-6¾) 1,422 12¾	2,501 19½	545 565 ..	36,764 13 9	5,503 4 0	42,268 1 9	1,561 3 0	40,706 14 9	248 15 0	216·	15·2	57·9	36·2	
X ..	Do. ..	..	5,241 34	C. M. Srs. (91½-3 - ½) 1,919 15	3,322 19	565	51,382 0 0	6,645 7 3	58,027 7 3	1,951 6 0	56,076 1 3	256 2 0	236·	8·5	57·7	36·6	

From the statement it will be seen that the average yield of kapas per acre comes to 278 lbs. as against 382 lbs. per acre of the last year on account of unfavourable season. The ginning percentage varied from 33 to 35 in the case of 1027 A.L.F. while it was 36 in the case of Selection I.A.

19. *Seed Distribution.*—Total quantity of seed purchased by the Department was 8,25,347 lbs. from the controlled area and 9,82,986 lbs. second hand seed supervised and purchased by the temporary staff entertained for the purpose making a total of 1,808,333 lbs. In addition to this 1,05,720 lbs. of seed from the Sonsak Co-operative Cotton Sale Society was supplied to Cambay, Broach, Thasra and Halol, *i.e.*, beyond the river Narmada, making the total quantity of seed handled by the Department to 1,914,053 lbs. Of this, 1,799,053 lbs. were distributed and 1,15,000 lbs. were kept as a reserve for resowings from which sales were going on till the end of August.

Out of the total quantity of 1,914,053 lbs. 3,42,231 lbs. were of Selection I-A. type and the rest of 1027 A.L.F. type.

20. In order to give convenience to the public and to popularise the seed, eight seed depôts were started at different places in the tract, of which two were managed by the Director of Agriculture, Baroda State, and the rest by the Cotton Superintendent and his staff. In order to further popularise the seed the following few more steps were taken :—

(1) Prevailing upon the cotton merchants to pay fairly good premiums for kapas grown from Farm seed.

(2) Distribution of leaflets on a large scale showing the advantages of growing improved seed supplied by the Agricultural Department.

(3) Seed-propagandistic work by the staff.

And above all the most noteworthy feature of the seed distribution work is the part played by some of the members of the Cotton Committee in securing or even purchasing the seed on their own account and distributing that amongst their own clientale in the hope of securing good cotton for ginning in their gins next season.

21. The first and foremost among them is Sheth Bamanshaw Jamasji. He last year tried to secure about 2 to 3 lacs lbs. of seed by purchasing kapas grown from farm seed paying very high premiums to the cultivators, say in some cases upto Rs. 15 or more per bhar, and ginning the lot separately. In addition to that he purchased 8,50,000 lbs. of second hand seed through the Department and distributed the whole lot in Ankleshwar, Hansot and part of Nandod State. This year too he purchased 360,000 lbs. of 1,027 A.L.F. through the Department and the rest he has secured for himself and tried to distribute the same quantity as that of last year in Ankleshwar Taluka and Hansot Mahal and has indirectly induced the Nandod State to buy 6,00,000 lbs. of 1,027 A.L.F. and distribute it in the whole State once again so that the worst affected part with Goghari mixture has been purified in the best way possible only in two seasons.

I would here urge the Department to convey their thanks to Sheth Bamanshaw Jamasji for the greatest help he has given to the Department and to the trade in general.

22. Next to Sheth Bamanshaw should be mentioned the names of Messrs. Dahyabhai Sundarji, Ghelabhai Paragji, Jamshetji N. Kapadia and Manilal, the agent of Messrs. Narandas Rajaram and Co.

Having seen the advantages derived by Messrs. Bamanshaw and others who distributed farm seed amongst their own clientale this year, almost every gin owner in the tract has tried to secure seeds from farm improved cotton and distributed them amongst their own clientale as will be seen from the statement below.

Seed distributed by gin owners.

	Lbs.
(1) Vedchha Gin—Dahyabhai Sundarji	1,10,000
(*a*) Purchased by Sheth Bamanshaw J. Jambusarwala.	
(*b*) Distributed by the gin owner	1,20,000
(2) Navsari Gin—Mr. Ghelabhai Paragji	2,24,000
(3) Sisodra Gin—Mr. Ranchhod Pema	2,24,000
(4) Vesma Gin—Mr. Manilal Mulchand	60,000
(5) Maroli Gin—Mr. Nanchand Sadaji	1,50,000
(6) Maroli Gin, Mr. Dahyabhai Sundarji	50,000
(7) Sheth Virchand Nathubhai—Kasba	1,30,000
(8) Kapadia Gin, Surat—Sheth Bhikhabhai Bhulabhai	70,000
(9) Sheth Bamanshaw Jamasji, Surat	90,000
(10) Mr. Motiram Raghavji, Surat	48,000

23. The permanent staff would not have been able to secure such a large quantity of seed for distribution had it not been for the efforts of the temporary staff who tried to mark out nearly 13,000 acres in Bardoli, Jalalpor, Chorasi and Olpad Talukas under cotton for all practical purposes grown from our farm seed and got the resulting seed separately ginned. A large part of this seed was sold to Sheth Bamanshaw and to the Rajpipla State.

24. *Finances.*—In all Rs. 32,925 were advanced by the gin owners to the cultivators as usual at 6 per cent. interest as against Rs. 66,225 advanced last year as the Bardoli group

people were not given any advances so also the Ankleshwar group people did not get anything.

For purchasing seed and other expenses of opening seed depots Rs. 1,04,000 were advanced by the Director from his personal ledger account as against Rs. 72,000 advanced last year. It is hoped that after defraying all the expenses of depots and paying depot keepers, etc., there will be a net profit of about Rs. 1,000. The profit would have been more like last year had it not been for a big drop of nearly 10 to 12 rupees per galli in the prices of cotton seeds soon after they were purchased by the Department for distribution.

GENERAL CONCLUSIONS.

25. *Goghari mixture.*—I am very glad to state that the Agricultural Department within a very short time of only 3 to 4 years has been able to eliminate the mixture of the inferior Goghari cotton from the Surat Deshi South of the Narmada to a negligible quantity. Had prompt measures not been taken by the present Director of Agriculture, Dr. Mann, a very serious and exceedingly difficult situation of a hopeless Goghari mixture would not have been averted. From the reports of the Cotton Superintendent, the Goghari mixture in the cotton crop of the tract is as follows :—

Taluka.	1919-20.		1921-22.	
	Number of villages studied.	Percentage of Goghari.	Number of villages studied.	Percentage of Goghari.
Chorasi	13	2 to 35	8	3 to 7
Olpad	15	6 to 36	9	5 to 8
Jalalpore and Chikhli	5	18 to 28	13	7 to 9
Bardoli and Valod	20	6 to 35	8	1 to 5
Mandvi	..	....	7	4 to 6
Ankleshwar (Broach)	..	....	7	2 to 4
Hansot (Broach)	..	....	5	7 to 14

From the above it will be seen that the efforts are crowned with success through the efforts of the Department and the trade.

26. I can also say that with very few exceptions the crop in the Jalalpor, Chorasi, Chikhali, Bardoli and Valod talukas is almost pure and that in Olpad and Mandvi still contains 5 to 7 per cent. of the mixture. Similarly Ankleshwar and Hansot which grow very impure seed are now almost free, thanks to the efforts of Sheth Bamanshaw who has distributed the seed throughout these talukas last year and this year.

ECONOMIC ADVANTAGES.

27. To try to assess the advantages, in money value, derived by the cultivators of the tract South of the Narmada by the distribution of this farm improved cotton is a very difficult and controversial matter. I shall only here try to give a rough idea as to their probable gain as under :—

	Premiums obtained. Rs.
To the cultivators of the controlled area of 9,000 acres ..	45,000
To the cultivators of areas sown with seed distributed by the Department about 1,00,000 acres @ Rs. 2½ per acre or Rs. 10 per bhar	2,50,000
1,50,000 acres area sown with seed distributed by the ginners themselves at the same rate	3,75,000
Enhanced rates obtained on account of the general improvement in the quality of lint of the tract below Narmada ..	10,50,000
Total ..	17,20,000

From the above it can be fairly said that the net gain to the cotton cultivators south of the river Narmada can be fairly estimated at the minimum at Rs. 15,00,000 and at the maximum at 20,00,000 during the year under report even though the outturn of cotton was only 8 to 10 annas.

28. Marketing the produce of the controlled area :—

The question of marketing the produce of the controlled area is getting more and more difficult on account of the following reasons :—

(1) The auction sales have to be notified at least 3-4 days in advance and on account of the fluctuating rates of the commodity and if the market has gone down by the time, the auction sales have to be postponed.

(2) The lot offered for sale being very small does not attract the big consumers and the local agents sometimes go into a pool, following a very short-sighted policy.

(3) Cultivators expect the same sort of big premiums they got in the first one or two years when they had no other reliable competitors. Nowadays thousands of bhars of kapas of the same quality is for sale side by side with theirs and hence the trade hesitates to pay higher premiums for similar quality.

(4) On account of the small lots that are offered for auction sale, the big merchants from Ahmedabad and Bombay do not attend the sales personally but ask their local merchants who are also ginners or traders in cotton and if they pay big premiums the tone of the market goes up and hence they are losers in their big concerns.

(5) Cultivators also want to use their discretion in the sales and they are not unanimous as to whether they should sell the lot or hold it over for next auction and which the traders resent.

Of all these the first three are very important and unless and until some method is found out by which the controlled area people get good premiums, it will be very difficult with the Department to induce the group people to continue to grow our seed as our seed growers. It will be much better and easier if some big firm comes forward and offers a fixed premium over the local rates of the day and if the whole produce can be sold to that firm.

(3) WORK DONE ON AGRICULTURAL STATIONS.

(I) *Surat Agricultural Station.*

29. *Seed selection and plant breeding.*—

(1) *Cotton.*—Cotton seed sufficient to sow the farm area with selected strain of Selection I—A. Long Boll Type was supplied by the breeding branch. The total area under cotton largely sown with the above type was 86 acres and 38 gunthas, which yielded 440 lbs. per acre on an average as against the average yield of 286½ lbs. of the surrounding villages of the Athwa group. Besides it was superior in ginning percentage and staple.

(2) *Jowar.*—Selection of important varieties of Budh Perio and Chapti has shown good results. In case of Chapti and Perio, large grained seeded varieties, the increase is appreciable, *i.e.*, 11 per cent. and 14 per cent. respectively.

30. *Cultural Experiments.*—Dibbling *versus* drilling of cotton gave appreciable results in favour of the former, and besides maintaining ideal tilth and cleanliness made the operations easy and convenient at any time. The results are tabulated below :—

Year.	Dibbling. 3′×3′		Drilling. 2′×1′	
	Principal product.	Bye product.	Principal product.	Bye product.
1916-17	567	673	500	705
1917-18	444	967	406	816
1918-19	436	625	377	571
1919-20	472	944	390	780
1920-21	524	867	455	741
1921-22	437½	525	340	433

31. *The new experiments of growing cotton and jowar on ridges.*—These were commenced last year. Their aims and objects were given in paragraph 26 of that year's annual report of the Department and are not repeated this year. Jowar was drilled on the ridges, which grew cotton last year, after necessary repairs to the ridges. The results are tabulated in the following statement :—

Statement showing the results of Cotton (1920-21) and Perio Jowar (1921-22) of High Yield Experiment on the Agricultural Station, Surat.

Plot. No.	Area Gts.	Treatment 1920-21.	Outturn per acre Cotton. 1920-21. P.P.	Treatment 1921-22.	Outturn per acre Jowar. P.P.	1921-22. B.P.
5-A	8	Dibbled Ordinary 2′ by 2′	481·4	Drilled 2′ by 1′ ..	945	1,600
5-B	8	Do. ..		Do. ..	900	1,465
6-A	8	Dibbled 3′ by 3′ ..	636·4	Drilled 3′ by 1′ ..	945	1,630
6-B	8	Do. ..		Do. ..	960	1,770
7-A1	4	Ridged 6′ by 1½′ Irrigated 6 inches twice.	893·12	(7-A). Drilled 6′ by2′ by¾′	1,340	3,280
7-B1	4	Do. ..		(7-B) Do. ..	1,475	3,385
7-A2	4	Ridged 6′ by 1½′ Dry ..	813·12			
7-B2	4	Do. ..				
8-A1	4	Ridged 6′ by 3′ Irrigated 6 inches twice.	1,035	(8-A) Drilled 6′½by2′ by1½′	1,635	3,865
8-B1	4	Do. ..		(8-B Do.	1,517½	3,600
8-A2	4	Ridged 6′ by 3′ Dry ..	872·8			
8-B2	4	Do.				

32. As new ridges had to be prepared for the cotton crop they could not be prepared on account of continuous rains till the middle of August and hence the sowing of cotton was delayed till after that time and as the late rains failed the yield of cotton plots was not worth being compared with the other plots. The advantages of this new system were given in details in the last year's reports on page 52 and hence they have not been repeated here, though they are more confirming from the jowar results reported above in such a wet year.

33. *Breeding Herd.*—The Kankrej breed of cattle is being maintained on the station since 23 years with the object of improving their milk production and at the same time providing the cultivators of the District with pedigree stud bulls.

The strength of the herd on 1st April 1922 was 112 as against 102 of last year as will be seen from the following statement:—

Statement of the strength of the herd on the 31st March 1922 on the Surat Dairy.

Description.	Strength of the herd on 1st April 1922.	Purchased.	Transferred.	Born.	Total.	Sold.	Died.	Transferred.	Total.	Balance on 31st March 1922.	Value on 1st April 1921.	Value on 31st March 1922.
Cows ..	30	..	8	..	38	2	..	..	2	36	2,420	2,925
Heifers ..	15	..	11	..	26	1	..	8	9	17	775	715
She-Calves ..	35	..	..	14	49	1	6	11	18	31	648	441
Bull Calves ..	20	..	..	16	36	2	8	..	10	26	1,135	944
Stud Bulls ..	2	..	..	..	2	..	..	..	2	2	600	600
Total ..	102	..	19	30	151	6	14	19	39	112	5,578	5,625

Cows Pitambari, Lehra and Budhi have still kept up the record. They have yielded more than 3,000 lbs. of milk in nine years' average.

34. During the year under report there were 30 births as against 27 of last year and 14 deaths as against 7 (increase due to protozootic disease prevalent amongst weaned calves). This disease is said to occur in a season of heavy and continuous rains.

(2) *Broach Farm.*

35. This farm was started with the sole object of finding out the most suitable type of cotton for the Broach tract. The work at present mainly consists of varietal, cultural, manurial and breeding trials in cotton. The work of segregating and growing pure strains of Lalio and Wagad cotton for North Gujarat was mostly transferred to the plot at Sanand after keeping only one strain of each of the types for the sake of safety.

36. The work in Goghari cotton is almost all discontinued except to a very small extent for preserving a few strains of high ginning qualities for crossing with superior stapled cottons of low ginning percentage.

37. Nearly the whole cotton area, *i.e.*, 15 acres 18 gunthas of the farm was sown with Selection I-A Cylindrical Boll Type having a better ginning with a fairly good staple and the resulting seed will be distributed to selected cultivators for increasing the seed.

Selection work in Rabi jowar was also commenced this year.

(3) *Nadiad Farm.*

38. On account of the stringency of money and on account of the object of growing fodder on the farm not being fulfilled due to insufficiency and brakishness of water in the only existing well on the farm, it was resolved to wind up the farm from the beginning of the current year and take up the Association plot at Nadiad from the Agricultural Association under the Deputy Director's control and turn it into a Tobacco Breeding Station.

39. Some area was utilised for the growing of chicory but as the buyers, Messrs. Polson's & Co., Ltd., could not buy the stuff, it had to be discontinued.

40. The trial of growing foreign sugar beet was continued by indenting fresh and better seeds from America and Europe. The yields are encouraging as compared with those of the last year. The sugar contents are also higher. Every trial was made to reduce the cost of cultivation but on account of the weedy nature of the soil and very high wages the cost is more than what it ought to be in ordinary circumstances. The two years' results are tabulated below :—

Name of variety of sugar beet.	Yield per acre in years.		Cost of cultivation per acre during 1921-22.	Value of produce per acre during 1921-22.	Net profit per acre during 1921-22	Sugar percentage in years.	
	During 1920-21.	During 1921-22.				During 1920-21.	During 1921-22.
	Lbs.	Lbs.	Rs. a. p.	Rs. a. p.	Rs. a. p.		
French Vilmorin A. ..	10,371	30,080	346 9 2	752 0 0	405 6 10	18·33	21·09
Do. B. ..	18,876	28,000	346 9 2	700 0 0	353 6 10	17·39	18·62
Sutton refined ..	20,570	26,800	346 9 2	670 0 0	323 6 10	17·60	19·21
American ..	23,672	28,000	346 9 2	700 0 0	353 6 10	17·70	23·15
General, raised from seeds dibbled ..	..	18,800	340 9 2	470 0 0	129 6 10	..	..

From the results it will be seen that the transplanting of seedlings has proved its superiority over the dibbling of seeds.

(4) Dohad Farm.

41. *Seed Selection.*—This was continued in wheat, maize and gram.

The Plant Breeding Expert has grouped the varieties and crosses of wheat and made selection of those true to type and the rogues found while selecting were removed. Further trials and observations will be continued.

W × P (Wajia × Popatia) cross has continued its superiority as a high yielder and mostly rust-resistant. Some splitting was observed which was noted and purified.

Seven promising strains of the local Wajia variety were tried on a field, scale of which three have done well in comparison to the ordinary local variety.

42. Almost all the seeds produced on the farm of the most promising wheat varieties, *e.g.*, Pissi, Pusa 4, Pusa 12, and Bansi were distributed in the tract. The cultivators have taken to Pusa 4 variety like anything. One sees several fields in any village round about the farm and also in many villages in the district. Not only the yield of this is good, but it fetches 50 per cent. more price per maund than the local Wajia.

43. *Maize.*—The selection work is continued this season as suggested by the Plant Breeding Expert.

I am sorry to state here that the cultivation of maize on the ridge and furrow system could not be continued this season as no ridges were prepared before the rains and they were not allowed to be prepared after the rains as they were continuous.

(5) Amalsad Farm.

44. The same experiments to check red-rot in sugarcane were continued with the same seven varieties of sugarcane and to which red sports from Manjri (a very promising and early variety) was added.

Fortunately no red-rot appeared this year also. The investigations of the Agricultural Chemist were discontinued from this year as he found no traces of injurious salts either in the well waters or in the soil of the farm.

45. Out of the eight varieties tried on the farm, (1) J. 247, (2) Manjav, (3) Striped Mauritius, (4) Malbari, (5) Red Mauritius have given very promising results. Also Red Sports seem to promise well but as sufficient canes were not available for crushing for comparison, its yield figures are not given. The following statement gives the yields, etc., of the promising canes :—

Yield statement of sugarcane varieties grown on Amalsad Sugarcane Farm during 1921-22.

Plot No.	Name of variety.	Yield of cane in lbs. per acre.	Yield of gul in lbs. per acre.	Cost of cultivation per acre.	Value of produce per acre.
				Rs. a. p.	Rs. a. p.
1*a*	Stripped Mauritius Manured	78,672	7,456	655 8 0	900 4 8
2*a*	Red Mauritius Manured ..	65,360	6,232	632 4 8	788 0 8
3*a*	Manjav Manured ..	76,400	7,072	634 12 8	846 8 8
4*a*	Malbari Manured ..	67,120	7,048	664 10 8	1,243 15 4
6*a*	J. 247 Manured ..	108,560	8,240	681 6 0	950 13 4
6*b*	J. 247 Unmanured ..	106,400	8,000	551 12 8	992 13 4
10*a*	J. 247 Manured ..	135,900	9,900	839 12 8	1,143 0 4
10*b*	J. 247 Unmanured ..	116,200	8,500	693 3 8	1,024 4 4
14*a*	Manjav Manured ..	111,600	9,568	779 6 0	1,191 2 0
15*a*	Red Mauritius Manured ..	70,320	6,256	764 4 0	722 5 4

From the statement it will be seen that the yield of J. 247 and Manjav are exceedingly good. Striped Mauritius, Malbari and Red Mauritius would have given equally good results had they not lodged like the other two on account of high winds and heavy rains in July-August. Though the yield of Malbari is much lower than the first two, it has fetched the highest value as it comes in the market the earliest and the quality of its gul is also much better and hence better prices.

46. *Demand for Sugarcane Seed.*—The demand for seed of many of the above promising varieties was so great that the greater portions of the plot under them were sold to cultivators for seed at 5 per cent. premium rates over the local canes after keeping only small portions for crushing canes for securing the comparison data.

47. After the farm has been in this locality for six years or more, the farmers round about have now been convinced about the advantages of (1) preparing land by iron ploughs and ridgers and (2) planting of the canes after the farm method instead of sowing the whole canes according to local method. During the year under report 10 surrounding cultivators applied for the loan of the above two implements and planted canes after our method.

II.—AGRICULTURAL EDUCATION.

(*1*) *Vernacular Agricultural School at Godhra.*

48. This being the second year of the commencement of the school, both the classes were regularly held from 1st June 1921. For admission in the first year's course, more than 50 applications were received, out of which 14 boys were selected and admitted. Thus the classes began with 17 boys in the second year and 14 in the first year. Classification of these stood as under :—

According to Caste.	No.	According to district.	No.
Dharalas	13	Panch Mahals ..	17
Patidars	13	Kaira	7
Rajput	4	Ahmedabad	1
Gosai	1	Broach	6
Total ..	31	Total ..	31

49. *Health.*—The general health of the whole institution remained quite satisfactory throughout the year. Special arrangement was made for weekly visits of a doctor from the Godhra Civil Hospital for inspection of the health and treatment of the boys.

50. *Practical training.*—The boys spent nearly half the time in practical work. The land attached to the school consists of 26 acres and it was all waste when the school was started. Now about 20 acres have been brought under cultivation, and various crops both dry and irrigated were grown during the year, all the operations on the farm being mostly done by the boys themselves without the help of the labourers.

51. *Donations.*—Mr. R. R. Dalal of Godhra was kind enough to give 12 cots gratis for the boys worth Rs. 40. In addition to the above he gave Rs. 25 cash prizes to the boys. A sum of nearly Rs. 40 was also received as donation from various people for giving prizes and sweetmeats to the boys. Thanks are due to all these generous donors.

A prize distribution ceremony was performed on 5th December 1921 at the hands of the Director of Agriculture. This was attended by the Collector, landlords, gentry, cultivators and others numbering about 200, and prizes in the form of iron ploughs and books of agriculture and allied subjects were distributed to the last year's successful students.

52. *Annual Examination.*—This was taken by Messrs. K. M. Pawar, Inspector of Agricultural Schools, and V. M. Majmudar, District Agricultural Overseer, Panch Mahals in April 1922. The results are as under :—

Number of boys.

	Appeared.	Passed.	
First year ..	13	9	One passing in first class.
Second year ..	17	14	*plus* 3 passed with grace.

The result was satisfactory on the whole.

53. Accounts of the school for the year 1921-22 are given below :—

Receipts.	Rs. a. p.	Expenses.	Rs. a. p.
1. Government grant ..	8,140 5 9	1 Establishment ..	3,003 0 0
		2 (*a*) Remitted to Karia Treasury (Godhra Sub-Treasury).	10 12 3
2. Sale-proceeds ..	10 12 3	(*b*) Paid into Poona Treasury by the Director of Agriculture, receipts, from the District Local Boards, Panch Mahals.	300 0 0
3. District Local Board, Panch Mahals.	300 0 0	3 Petty construction and repairs ..	149 3 3
		4 Cultivation charges ..	600 0 0
		5 Purchase of food and fodder ..	398 15 9
		6 Purchase of implements ..	396 14 3
		7 Boarding charges ..	2,200 0 0
		8 Purchase of books ..	12 5 6
		9 Office expenses and miscellaneous. .	230 0 0
		10 Cattle shed ..	300 0 0
		11 Boring charges ..	686 2 0
		12 Conservancy charges ..	119 5 0
		13 Postage and Telegrams ..	40 0 0
		14 Travelling Allowance ..	4 8 0
	8,451 2 0		8,451 2 0

From the above it will be seen that the school is very economically managed and the credit is due to the able management of the Head Master, Mr. J. G. Naik, B.Ag.

(2) Vernacular Agricultural Education in the Bhil Boarding School at Dohad.

54. The teaching of the new classes began with eight boys in the first year and seven boys in the second year. The annual examination of these boys was held by Mr. V. M. Majmudar in March 1922. The results were :—

	Number of boys.			
	Appeared.	Passed		Failed.
		fully.	with grace marks.	
First year	8	6	1	1
Second year	7	6	1	..

The result on the whole was satisfactory.

(3) Publications on agricultural matters.

55. The publication of the Broach Quarterly Magazine was continued as usual. The published matter was mostly supplied by the agricultural staff of Gujarat. In all 30 articles on various agricultural subjects were received from seven members of the staff for the above magazine.

In addition to the above Mr. M. L. Patel has supplied material for publishing a memoir on Goghari cotton and which is published as " Studies in Gujarat Cottons, Part I, " in the memoirs of the Department of Agriculture in India, Botanical Series, Volume XI, No. 4, for December 1921.

III.—DISTRICT WORK.

56. This work was carried on as usual by the Divisional Superintendent of Agriculture, N. D., in his charge of the three districts of Northern Gujarat, *viz.*, Ahmedabad, Kaira and the Panch Mahals. There are three District Agricultural Overseers, one for each district, who are assisted by two Kamgars, ploughmen and depôt keepers.

57. The charge of the two Southern Districts of Gujarat, *viz.*, Broach and Surat, is directly under the Deputy Director of Agriculture ; but the posts of the District Agricultural Overseers were vacant till February and May 1922 respectively ; and the urgent district work was performed by the Superintendents, Broach and Surat Farms, for their respective districts in addition to their own duties.

58. *Demonstrations and Shows.*—During the year under report 14 big and small demonstrations and shows were held as noted below in different places and on the farms :—

	Place.	District.	Demonstration or show.	Date on which held.
1	Surat Farm ..	Surat ..	Party demonstrations and magic lantern show.	8th and 9th December 1921.
2.	Lavachha (Taluka Pardi)	Do. ..	Demonstration ..	7th January 1922.
3.	Ahwa (Dangs) ..	Do. ..	Demonstration and magic lantern show.	7th to 9th Apirl 1922.
4.	Broach Farm ..	Broach ..	Party demonstrations ..	16th to 18th January 1922.
5.	Chharodi Farm ..	Ahmedabad ..	Demonstration and show ..	8th to 10th December 1921.
6.	Aslali, Taluka South Daskroi.	Do. ..	Demonstration ..	20th December 1921.
7.	Prantij ..	Do. ..	Do. ..	8th January 1922.
8.	Ranpur, Taluka Viramgam.	Do. ..	Do. ..	10th January 1922.
9.	Ajupura ..	Kaira ..	Party demonstration ..	20th, 21st December 1921.
10.	Dohad Farm ..	Panch Mahals	Do. ..	15th February 1922.
11.	Vejalpur, Taluka Kalol..	Do. ..	Demonstration ..	19th February 1922.
12.	Taravda ..	Do. ..	Do. ..	15th January 1922.
13.	Limbdi, Taluka Jhalod..	Do. ..	Do. ..	6th March 1922.
14.	Bahi, Taluka Godhra ..	Do. ..	Do. ..	22nd and 23rd February 1922.

The total cost came to Rs. 979-12-3.

A special demonstration in the Dangs at the time of the Durbar was also arranged by the Superintendent, Surat Farm, and his staff, at the request of the Dangs' officers.

A set of suitable implements worth Rs. 235-8-0 is kept with the Dangs Dewan for demonstration in the Dangs.

The most noteworthy feature of these demonstrations is that the Honourable Mr. C. V. Mehta, the Minister in charge of Agriculture, graced the occasion by his presence at the Party Demonstrations held at Surat on the 8th and 9th December 1921.

59. *Implements and Seed Depôts.*—The depôts at Godhra, Dohad and Jhalod were continued and the depôt at Aslali was re-opened. The Halol depôt was shifted to Kalol.

Implements and spare parts worth Rs. 312-8-0 were sold from the Aslali depôt while the hire charges earned by all the depôts only amounted to Rs. 45-10-0. From these figures it will

be seen that they are total failures in Upper Gujarat, unless and until some new implements suitable to the tract are discovered and supplied.

60. *Distribution of seeds and Implements.*—The following statement shows the distribution of different kinds of seeds and implements from the farms and depôts :—

Kind.	Surat Farm.	Nadiad Farm.	Dohad Farm.	Broach Farm.	Depôts and District Agricultural overseers.	Total.
Jowars (grain) ..	4,668	....	....	2,310	2,695	9,673
Do. Fodder ..	600	1,770	....	80	60	2,510
Cottons ..	20,885	....	10	1,920	54,499	77,314
Paddy ..	....	20	210	....	....	230
Wheat ..	....	30	4,638	....	200	4,868
Gram ..	....	....	710	....	....	710
Maize ..	....	....	585	....	....	585
Bajri and Bajro ..	....	170	....	....	130	300
Tur ..	217	175	2	....	410	804
Groundnuts ..	25	....	125	....	580	730
San seed ..	442	....	2,720	3,840	300	7,302
Wal seeds ..	1,019	10	....	....	30	1,059
Vegetables ..	35	....	....	221	474	730
Other seeds ..	103	154	176	41	313	787
Total ..	27,994	2,329	9,176	8,412	59,601	1,07,602

(2) Implements :—

———	Surat Farm.	Nadiad Farm.	Broach Farm.	Depôts and District Agricultural overseers.
Number ..	30	65	3	76
Value ..	Rs. a. p. 963 4 0	Rs. a. p. 294 8 3		Rs. a. p. 312 8 0

In addition to the above the cotton seeds of improved varieties distributed by the Cotton Staff amounted to 18,08,333 lbs. as reported elsewhere under that head.

To meet the increased demand for seeds, etc., Mr. P. R. Kanhere, a big landlord and an agricultural graduate of the Poona Agricultural College, has opened a seed store at Nadiad.

61. *Demonstrational Plots.*—These were conducted on the cultivators' fields and on the same lines as those mentioned in paragraph 60 of the last year's report.

The following statement gives the number of plots and the area worked:—

District.	No. of plots.	Area	Remarks.
		A. g.	
Surat	8	29 32	
Broach	1	..	
Kaira	39	26 3	
Panch Mahals	28	48 34	
Ahmedabad	31	35 ..	

62. *Measures to prevent Smut in Jowar.*—In all 3,275 packets were distributed as under :—

District.	Number of copper sulphate packets.
1 Kaira	130
2 Broach	2,195
3 Surat	950
	3,275

In addition to the above cultivators of Surat and Broach Districts who are convinced of this treatment regularly purchase the stuff from the Bazar and use every year.

63. From the above statement it will be seen that the Department has been trying to push forward every conceivable improvements either small or big even in the highly developed and advanced part of Gujarat.

Entomology.

64. On deputation of Mr. T. N. Jhaveri to the special line of research, his post remained vacant in the Division. However in case of urgent necessity his help was taken for which the Department is much indebted to the Trustees of the Sir Sassoon David Trust Fund for allowing Mr. Jhaveri to do this useful piece of work.

65. Two insect pest shows and magic lantern demonstrations were made, one at Surat and the other in the Dangs forest, which were largely attended by the cultivators and were successful in producing good impressions on their minds.

66. *Katra or Hairy Caterpillars* (*Amsacta Moorii*).—The people of Kaira and Panch Mahals during the Director of Agriculture's tour in Gujarat complained of a serious damage to their crops by katra. Thereupon according to the suggestions of the Director of Agriculture two badly affected villages in each of the Districts have been selected with the consent and help of the cultivators concerned to try to control this pest by dusting large areas with Paris Green Powder in the next season.

67. *Cotton Woolly Mites*—(*Eriophyes gossypii*).—To keep up the continuity of the last year's experiment, the controlling trials of this disease were carried out at Surat according to the scheme suggested by Mr. Jhaveri.

The selected cotton seeds before sowing were steeped in 2 per cent. mercury perchloride solution. The leaves of cotton affected with woolley mites were plucked off from time to time. Thus in the steeped treated plot, the percentage of disease varied from ·008 to ·02 per cent. The yield of seed cotton of this plot was 624 lbs. 4 ozs. per acre, while that of the unsteeped and untreated plot was 408 lbs. per acre in one case and 473 lbs. 13 ozs. per acre in the other. After all pickings of cotton were over, the disease was allowed to develop and increase more in both the cases for about two months, which showed in the month of June 1922 an increase of 27 per cent. in the steeped and treated plot, while in that of the latter it rose upto 92 per cent.

Such steeped seeds were supplied to about two cultivators in the District who, though did not try any further operations of plucking off affected leaves later on, got better yield of the crop in comparison with other plots of unsteeped seeds.

Thus a plot of the steeped seeds gave an outturn of 485 lbs. 13 ozs. of seed cotton per acre while that of unsteeped seeds varied from 300 to 380 lbs. per acre and the development of the disease was also more in the latter.

68. *Jowar Stem Borers.*—(1) Anthomyiad fly, (2) Chilo simplex, (3) Sesamia inferens.

The special work on the investigations of various borers of jowar is carried out by Mr. T. N. Jhaveri, Special Entomological Officer of the Sir Sassoon David Trust Fund, and some of his observations and investigations are as under.

The above three borers were observed to affect the kharif crop of jowar at various stages of its growth on Surat side. The first borer, namely, the Anthomyiad, was more prominent in the seedling stage of the crop and more so in a year of heavy rainfall. During the year its attack ranged from 5 to 26 per cent. in a crop of about 3 to 8 weeks old; while that of chilo ranged upto 6·25 per cent. In the case of the latter, the Hymenopterous and Tachinid parasites, were noticed to keep this borer in check. As for Sesamia which mainly affects the crop in its mature stage, it is found more prominent and active during winter and summer. Its attack during the year varied from 4 to 25 per cent.

Regarding the controlling trials of these various borers as well as other important points of their life history, habits, food plants, etc., a detailed work is under contemplation, which will be published separately in the form of a memoir.

69. *Campaign for the control of wild pigs and jackals.*—Owing to the deputation of Mr. T. N. Jhaveri as stated above and in the absence of any other suitable hand the propaganda and control work in this connection could not be carried out as that of the last year. But on demand from several officers and cultivators, poison packets of white arsenic and strychnine hydrochloride were distributed with necessary instructions of using them. In this way 1,135 poison packets were supplied at various places in the Presidency proper as detailed below:—

Name of the District.	Number of packets supplied.	
	Strychnine hydrochloride	White arsenic.
1. Surat	227	333
2. Broach	....	21
3. Panch Mahals	13	51
4. Poona	....	70
5. Ahmednagar	25	110
6. Nasik	5	5
7. Belgaum	..	75
8. Kolaba	10	55
9. Ratnagiri	10	25
10. Karwar	50	50
	340	795
Total ..	1,135	

The results of these trials as well as those of the last year were brought to the notice of the Committee on Protection of Crops from wild animals and necessary further steps will be taken if approved by that body.

70. *General.*—On the whole the work of the staff with few exceptions was very satisfactory.

BHIMBHAI, M.,
Deputy Director of Agriculture,
Gujarat, Surat.

Surat, 17th September 1922.

APPENDIX F.

WORK DONE UNDER THE DEPUTY DIRECTOR OF AGRICULTURE, KONKAN, DURING THE YEAR 1921-22.

INTRODUCTORY.

Area of Operations.—The Konkan division comprises the four districts of Thana, Kolaba, Ratnagiri and Kanara of the Bombay Presidency.

2. *Lines of Work.*—The work of the year 1921-22 has proceeded and developed along the same main lines as in the past, namely—

(1) Experimental and research work including investigations into new possibilities;

(2) Extension work or popularization and introduction of improvements into the practice of agriculturists;

(3) Agricultural education.

3. The following are the broad features of further development during the year of the organisations for carrying out the work on the above lines :—

Now that a better provision has been made to carry on rice investigations at the Rice Research Station at Karjat, and a Varkas Land Station has been established in the Ratnagiri district, it was thought that there was no necessity of continuing the Alibag Agricultural Station and it has therefore been closed from the end of the year.

Similarly as the Agricultural School at Alibag has failed to attract sufficient number of boys during the last three years during which it is being run on the Loni model, it is ordered to be closed after the school year ended in April last.

The entomological investigations could be again resumed as an incumbent was available for the post of the Entomological Assistant, Konkan.

An incumbent has also been available for the vacant post of the Agricultural Investigator at the Kumta Agricultural Station and it is hoped that cocoanut investigations could now be started.

It is satisfactory that popular representation and influence have been introduced in the organisation and control of agricultural propaganda by way of the Divisional Boards which have been created during the year. Government have also announced their desire to stimulate local effort to take up the work of agricultural propaganda by offering to subsidize them with funds to the extent of the local contributions upto a limit of Rs. 1,000.

The propaganda work in the Thana district had to be suspended as the Agricultural Overseer had to proceed on long leave on account of his ill health and pending training of a fresh recruit who has been taken up as a substitute.

The demonstration farm for East Kanara to be worked under cultivators' conditions, which was referred to in the last year's report as projected, commenced work during this year.

The classes which were organised for the propaganda staff were very useful in refreshing and bringing their knowledge and methods of the work they have to do up to date.

4. *Staff.*—The strength of the superior technically educated staff of assistants capable of responsible work stands as follows in comparison with that of the last year :—

	1920-21.	1921-22.
Research and Experiment	9	8
Extension or Propaganda	5	5
Agricultural Education	2	2
	16	15

The proposal for an additional post for the Mundgod Demonstration Work was rejected by Government and one of the graduates' posts of the Alibag Agricultural Station to be closed was made available for the purpose instead.

The need for one supernumerary graduate and one non-graduate to act as leave relievers not being fulfilled the efficiency of work continues to suffer.

5. *Cost of the year's work.*—The following statement will furnish the information in abstract for each broad division of activities :—

Class of work.	Establishment (pay and allowances).	Contingencies.	Total.
	Rs.	Rs.	Rs.
Research and Experiment	22,178	37,263	59,441
Extension or propaganda	18,346	4,682	23,028
Agricultural Education	5,747	19,209	24,956
Direction and Superintendence	13,204	1,995	15,199
Total ..	59,475	63,149	122,624

6. *Physical conditions influencing the agriculture of the year.*—The rainfall and season on the whole were favourable, the submontane tracts of the North Konkan had insufficient rains and suffered some loss in the outturn. There were no serious insect pests excepting a swarming caterpillar pest in the Vengurla taluka of the Ratnagiri District.

The following comparative figures of the average outturn per acre of the principal crops calculated from the whole area under cultivation on the three farms representing three different conditions for the last two years as well as for the year when the average was the highest in the history of the three farms will give a clear idea of the combined effect of the above conditions:—

Farm and crops.	Average outturn per acre.			
	1921-22.	1920-21.	The last best year for the crop in the history of the farm.	
			Year.	Outturn.
Alibag Farm (Kolaba District).	Lbs.	Lbs.		Lbs.
Rice—Paddy	1,735	1,452	1912-13	2,719
Ratnagiri Farm (Ratnagiri District).				
Rice up-land—Paddy	1,824	1,968	1919-20	2,325
Rice low-land—Paddy	2,656	2,454	1919-20	2,695
Kumta Farm (Kanara District).				
Rice up-land—Paddy	1,310	900	1919-20	1,680
Rice low-land—Paddy	1,750	1,650	1919-20	1,900
Sugarcane—Gul	7,300	8,340	1919-20	8,000

7. *Progress made in the year.*—The various directions in which work was carried out together with the progress made in each are summarised below under the three main sections mentioned under 'Lines of work' above.

Experimental Work.

8. For carrying out the experimental and investigation work we had four stations as follows:—

(1) Alibag, (2) Ratnagiri, (3) Kumta and (4) Karjat Rice Research.

Some simple tests were also carried out in the districts under the immediate direction and supervision of the propaganda staff.

The most salient features of any new findings of the year are summarised below, section by section, such of the items which have been continued from the previous years as not being yet conclusive, and which are merely in confirmation of the findings as recorded in the reports in the past, not being repeated in detail.

RICE.

9. Improvement of this crop occupies a main and prominent position in the programme of work of all the four stations mentioned.

10. *Seed-bed treatment.*—At Kumta *dhulwaph* (in dry soil before the break of the monsoon) sowing of seed-beds which gave the poorest results in the previous three years as compared with sowing under irrigation or sowing of sprouted seed after the monsoon starts, has this year given the best results; from this it may be inferred that the success of each method may be dependent on the nature of the season.

11. *Field manuring.*—On the Ratnagiri Farm the after-effect of green leaves of *rui*, which was markedly depressing on the crop in the previous year—the first after its discontinuance—has not only vanished but has given an increase of over 20 per cent. over the local treatment plot in this the second year after its discontinuance; somewhat similar has been the experience with *karanj* leaves on the Alibag Farm. Green and dry leaves on the Kumta Farm or manure prepared from them by using them as litter have given substantial increases over the no manure plots and would therefore serve as a chief source of manuring under Kanara conditions on account of the insufficiency of farm yard manure for all the area under cultivation. Dry leaves do for rice as well as or even better than green leaves in quantities based on equal units of labour employed for collecting.

It has been found that bulky manures such as urine earth, rice hulls, and cattle-folding leave no beneficial effect after one year of their discontinuance on the laterite soils of the Ratnagiri Farm, while on the trap soils of the Alibag Farm it took nearly five and three years to exhaust the residual effects of *mowra* refuse and rice hulls respectively. The application of small annual doses of nightsoil combined with rock phosphate or poudrette has not resulted in appreciably increasing the yields on the Ratnagiri Farm.

That concentrated manures such as fish, *undi* cake, and mineral forms like sulphate of ammonia and superphosphate applied in total substitution of farm yard manure are no good on soils represented by the Kumta Farm was confirmed a fourth time ; but a very remarkable fact has come to notice by this year's experiments that when these manures are accompanied by farm yard manure, the increases due to the concentrated manures are large as is illustrated by increases of 20 to 40 per cent. with sulphate of ammonia, of 60 to 84 per cent. with a combination of sulphate of ammonia and superphosphate and over 50 per cent. in one out of three cases of fish manure. The benefits from rock phosphate, with or without organic matter, are again large on the Kumta Farm but none on the Alibag or Ratnagiri Farms. Bone superphosphate tried on a cultivator's field near Alibag (Kolaba district) gave only 7 per cent. increase. As regards residual effect of several manures applied and discontinued, bone meal shows considerable benefit on all the three farms upto two years, as is also the case with mineral superphosphate and a combination of superphosphate and sulphate of ammonia on the Alibag Farm : the effects of fish, oil cake and sulphate of ammonia vanish comparatively earlier.

12. *Cultural.*—The puddle prepared by more economical implements of acme harrow or the Deccan blade harrow has on the Ratnagiri Farm been found to be of no less quality than that prepared by a plough as judged by comparing the yields of rice crops grown on both. The beneficial effects of inversion of the soil done in ploughing with the meston plough noticed in the annual report of the year 1918-19 are not confirmed in subsquent trials both on the Ratnagiri and Alibag farms.

13. *Varietal.*—Those varieties which have been noted as superior to local on the three farms in the last report have been found to be so even in this year.

RESEARCHES INTO RICE CULTIVATION.

14. This is the third year of carrying out intensive research work at Karjat for investigating into the possibilities of increasing, or economising the cost of obtaining, the present yield of rice. Mr. K.V. Joshi, B.Ag., assisted by one graduate assistant continued to be in immediate charge of the work.

As it was observed that it was impossible to obtain quite uniform conditions necessary for accurate scientific work in different plots under comparison, the plot investigations have been supplemented by pots.

The year's results of practical value are in most cases in agreement with the findings of the previous years. They generally indicate that the two factors of yield, namely the number of ear-heads per unit area and the average yield per ear-head are inversely related so as to compensate for one another, except when the fertility of the soil is increased by the addition of manures, in which latter case the increase in the number of ear-heads does not reduce the average yield per ear-head.

Thus variations in the age of seedlings at transplanting, in the number of seedlings planted per bunch, in the space allowed per bunch and in vigour of seedlings as adopted by cultivators do not present any scope for increasing the yield or effecting an appreciable economy in cost.

Manuring seems therefore the only method of bringing about an increase in yield. During this year it has been possible to reach a maximum of double the usual yield, with a dose per acre of 60 lbs. of nitrogen in the form of sulphate of ammonia combined with 120 lbs. of phosphoric acid in the form of mineral superphosphate ; the cost of this treatment however far exceeds the economic limit and it is to be seen how the maximum limit of yield reached can be secured within economic limits of cost. Nitrogen seems to have by far the largest influence in increasing the yield of rice, phosphoric acid being of doubtful minor importance in the trap soils as represented by Karjat. An increase in the number of ploughings for puddling appears to increase the yield to a slight extent. An increase in the depth of soil upto 18 inches is associated with a substantially increased yield; this last result is however more of explanatory than of practical interest, as increasing the depth of shallow soils does not appear to be an economic proposition.

Among the methods of growing rice without transplanting, the crop from dry seed sown in squares, in drills or broadcast once for all in the fields, gave again as in the previous year as high as or even better yield than that from transplanting. The application of this method seems however to be limited to fields in which the crop will not be submerged in water in its early growth, which condition is represented only to the extent of about 25 per cent. of the total area under rice cultivation in the North Konkan.

PROFITABLE CROPS IN PLACE OF AND FOR ROTATION WITH RICE.

15. *More profitable crops in place of rice on the poorer grade of makki (up) lands.*—On the Kumta Farm contrary to the last year's results rice has this year held its own against *ragi*, *vari*, and groundnut which were more profitable last year ; groundnut however compares favourably with rice.

RABI (DRY) CROPPING OF THE MOISTURE RETENTIVE RICE FIELDS.

16. *New crops.*—On the Ratnagiri Farm groundnut, sweet potato, chillies and *ambadi* which were grown on a plot scale this year maintain their profitableness noticed in previous years and may now be considered to have passed their experimental stage and to be ready for introduction. Sweet potato is the most profitable of the three and fares as well as or even bette:

on flat land than on ridged. Chillies thrive best when planted in furrows. The success of groundnut has also been confirmed in the trials on cultivators' fields in the Karwar taluka of the Kanara district. Out of the other crops still under trial on a row scale, melons have been very promising, tobacco hopeful, the yield from safflower being very poor.

Shalu jowar tried on cultivators' fields round about Karwar in the Kanara district grew well and has impressed the people.

IRRIGATION FARMING.

17. *Sugarcane.*—On the Kumta Farm, as in the previous year, Barbados 208 has by far beaten the local variety or all others tried, by its specially richer juice having special qualities for forming a hard crystaline *gul.* Striped Mauritius, Red Sport, Manjav come next having maintained their superior position both on the Ratnagiri and Kumta Farms.

The labour-saving methods of cultivation of ploughing the whole land deep and making the furrows with *sabul* plough has been found on the Ratnagiri Farm to be in no way inferior to the local method of planting in somewhat deeper trenches dug by hand.

Mr. V. R. Sabnis, B.Ag., Agricultural Overseer, Ratnagiri, found that the colour and hardness of the block of gul can be improved with slow fire at the final stage of boiling and continuing stirring and aerating the mass in the cooling stage.

18. *Tobacco.*—This new crop was a success on the Kumta Farm for the second time of its trial.

19. *Other new crops.*—Irrigated wheat of two kinds *Khapli* (spelt) and *Bakshi* (unspelt hard white) and *vaingan* (hot weather irrigated) rice were tried at Jambul, taluka Kalyan, in the Thana district, with a view to study their possibilities for introduction in irrigation farming to be developed under the tail waters of the Tata Hydro-electric works in the Western Ghats. Both the kinds of wheats were attacked by wheat-rust, the spelt wheat being however more resistent than the other; outturns were poor. *Vaingan* rice grew very well but it was very curious that all ear-heads were unfertilised and empty. The trials will be repeated once more.

FRUIT TREES.

20. *Cocoanut.*—The systematic experiments in verifying the effects of salt commenced in the last year in cultivators' gardens in the Kanara and Ratnagiri districts have not yet yielded results. In the Kanara district, *tephrosia candida* and *crotolaria striata* were tried as green manure crops in the cocoanut gardens and they have been found to grow well and furnish the necessary green matter in places where the same cannot be available from forests. In the Alibag taluka, an experiment in manuring cocoanut with bone-meal and nitrate of soda has been commenced in a cultivator's garden.

21. *Mango.*—The exact effect of common salt on grafted mangoes for which there is a considerable demand has been taken up for investigation in a private plantation in the Ratnagiri district; it would not be safe to attempt to draw any inference from only one year's results.

The success obtained in dealing with the mango-hopper pest is described in detail under Entomological work in this report.

22. *New fruit trees.*—The experimental orchard for trying new kinds of fruit trees which has been commenced on the Kumta farm since 1920-21 was continued and is being steadily developed as funds are available.

VARKAS LAND CULTIVATION.

23. In addition to the *Varkas* Land Sub-Station at Bandhan, near Alibag, in the Kolaba district, where *varkas* land experiments have so long been conducted, the new *Varkas* Land Investigations Station established at Hatkhamba in the Ratnagiri district also started actual work since the year under report.

The experimental work at Bandhan having reached some definite stage after which much good was not expected in continuing it further at that place was discontinued and the area used for demonstrating successful results of past work pending this station being given up. At Hatkhamba work has been concentrated on breeding of high yielding strains of *nagli* (Eleusine coracana). The results of the year are summarised below.

24. *Breeding of high yielding strains of nagli.—Nagli* is as important a crop as rice in the Ratnagiri district. It is also the experience that any substantial improvements in the matter of seed of existing crops is readily appreciated and quickly and easily adopted by the agriculturists. Remarkable results in this direction in Mysore and Madras hold out very strong hopes of similar success in Konkan.

Samples of *nagli* seeds, in all numbering 135, were obtained from several places in the Konkan districts and also a few reputed ones from Mysore and Madras, and were grown in separate rows. From one to three individuals which appeared to be the best to the eye from the crops of each of the promising samples out of them have been kept separately as material for selecting the best-yielding pure-breeding pedigree strains. In the meantime it has also been

noticed that there is a great divergence in the yields obtained for the different individuals, which offer good chances for getting strains which will give substantially higher yields than the local samples.

Detailed observations as regards the conditions under and the manner in which fertilization takes place in *nagli* were made and the evidence so far obtained leads to the conclusion that there is almost no chance for natural cross-fertilization. This makes the work so much easier.

25. *Best methods and economics of foresting the steep sloping, stony varkas lands:*—As all the time of one Graduate Investigator that could be made available for the Hatkhamba Varkas Land Station was occupied in the breeding of *nagli* which is likely to yield useful results in a short time, tree planting has to wait till one more Graduate and necessary funds can be made available.

IMPROVEMENT OF FODDER SUPPLY.

26. *Cultivated fodder crops.*—Guinea grass was tried along the water channels in betelnut gardens in Kanara District and has been found to grow and yield good green grass. The success obtained with *shalu jowar* in the *rabi* season after the harvest of rice in the trials at Karwar is of value.

Ensilage.—In the *pacca* silo at Hatkhamba (Ratnagiri District) good silage was made out of green grass, the proportion of silage obtained to the green grass put in being 60 per cent. The results of bringing this to the notice of agriculturists are noted under Extension Work of the Ratnagiri District further on in this report.

IMPROVEMENT OF CATTLE.

27. *Use of milk animals for work.*—Out of the pair of she-buffaloes which has been kept on the Ratnagiri Farm for this purpose, one which had the habit of abortion from the beginning lately developed chronic ill-health to which it succumbed. The other one continued to behave normally as regards maternity notwithstanding the farm work which was regularly taken from her either singly or as a mate with a bullock. A pair has also been kept for a similar purpose on the Kumta Farm since the year under report.

IMPROVEMENT OF MANURE SUPPLY.

28. *Best way of utilizing bare minor forest areas for supply of leaf manure in Kanara.*—Several kinds of plants which are reputed or likely to be useful for this purpose have been planted in the minor forest area at Kumta made over to the Agricultural Department for this purpose. There has been a fair amount of survivals through the dry season of the first year.

29. *Establishment of a plantation of Rui in Ratnagiri.*—The small plantation which has been established on the Ratnagiri Farm is not flourishing as well as stray plants in the odd places and chinks in stones on *varkas* lands. The reason for this is probably want of sufficient drainage and aeration in the upland field conditions in which they have been planted. A plantation has been therefore during this year started on regular stony and slopy *varkas* lands at the Hatkhamba Varkas Land Station.

30. *Utilization for manure of undi-cake which is at present burnt for fuel in Kanara.*—The great economic advantages of *undi*-cake used as manure for rice, gardens and sugarcane has been brought home to the cultivators and with their help the oil-mongers are now being explained better economic advantage to them than by burning and induced to sell it for manure. Substantial success has been obtained.

PROTECTION OF CROPS FROM WILD ANIMALS.

31. *Pig proof woven wire fence.*—The good results obtained with this measure of protection are noted under Extension Work of the Kanara District.

32. *Village shikari system on communal basis.*—The year's experience with this system introduced by the Honavar Taluka Agricultural Improvement Committee shows that the villagers themselves do not seem to be enthusiastic over it so as to organise themselves for this; there is no arrangement for supply of ammunition and some remuneration to the *shikari* and for supervision over his work.

33. *Poisoning.*—Encouraging effects of poisoning with strychnine have been noted under Demonstration Work in Mundgod further on in this report.

WORK ON INSECT PESTS.

34. A new graduate of the Poona Agricultural College who had specialized in Entomology having been available in Mr. P. V. Wagle, B. Ag., to fill up the vacant post of the Entomological Assistant, Konkan, the Entomological work which was suspended for one year was again resumed. The study of pests of the three important crops of Konkan, *viz.*, rice, cocoanut and mango, which was by no means complete was continued.

Rice pests.

35. *Stem-borers.*—During this year again, as in the previous two, stem-borers were practically absent and there was hardly sufficient material for study except a few odd corners.

The attack, here, was noticed early in September, *schinobius bipunctifer* being mostly found and very rarely *chilo simplex.*

Mr. Deshpande's observation about the caterpillar of the *schinobius* borer lodging itself during its hibernating period at the first above-ground node and thus indicating a possibility of the removal of good many of them by cutting the crop closer to the ground, *i.e.*, below the first node, as noted in the Annual Report of 1918-19, was verified but it was found that the caterpillars discend for their hibernation into the lowest internodes below the surface of the ground; thus the possibility of hitting at the pest in this manner is precluded. Mr. Wagle however found that uprooting of the stubble either by hand digging or ploughing and allowing them to lie exposed to the sun or making the stubble rot by heavy irrigation kills the caterpillars that may be hibernating in them. This result particularly the first part is likely to prove of great practical value in controlling the pest.

It was also observed that the caterpillar which ordinarily hibernates throughout the fair season to pupate, and emerge and breed at the break of the following monsoon, assumes these changes even earlier in the fair season if there is a rice crop present earlier, such as *vaingan* (hot weather) crop, which it attacks.

Four or five pests of rice of minor importance were noticed, identified and recorded.

Mango pests.

36. *Hoppers.*—Three species were noticed. The hoppers were found to breed three times in a year, in June and October, on the fresh and tender leaf-shoots that appear on the trees then and very profusely for the third time in December and January on the flower heads. The life history from egg to adult extends over a fortnight and the adult stage continues until the next time of blossoming.

Control of the pest was attempted in two ways:—(1) trapping the adults before flowering began, and (2) spraying of the flower heads.

The trapping was done by drawing a semi-circular channel made out of a tin sheet covered over on its inside with a sticky mixture, over the surface of the trunk and big branches of mango trees on which the adult hoppers of one of the three kinds rest in numbers. The sticky mixture was prepared from *undi* (callophyllum inophyllum) oil and rosin in the proportions of 1 to 2·25 respectively. In the operation of drawing this channel the hoppers were disturbed and in their attempts to fly off were caught in the sticky mixture to die. This device though fairly effective against the one species which rested on the trunk and branches of the tree could not at all deal with the other two species which pass their life on the under surface of leaves, and was not therefore of much practical value.

Spraying the flower heads, on the other hand, with fish-oil rosin soap, while the insects were yet in the hopper or wingless stage and could not therefore fly, was confirmed to be quite effective. A water solution with 1½ per cent. fish-oil rosin soap was found to be the optimum strength in point of efficiency and economy. Trees up to a height of 20 feet can be manipulated with a Holder Sprayer and a rubber tubing extension of 15 feet length. Two men can spray from 16 to 20 trees in a day of eight hours, and each tree, 10 to 15 years old, requires on an average ¾ pound of soap for one spraying. As hoppers continue to hatch out over a long period one spraying cannot control the pest but spraying has to be repeated up to six times at an interval of a week or so according to requirements. Thus the total cost per tree works out at Rs. 1-2-0 for soap and Rs. 0-6-0 for labour for six sprayings. A garden of about 100 trees was taken up for experiment, half the number in which was sprayed six times and the other half left unsprayed for control. Although the pest was but very mild this year, the outturn of fruit per sprayed tree was 226 against 148 per unsprayed tree or an increase of 78 fruit per tree which in the case of grafted kind is valued at five to seven rupees according to the fluctuations in the market rates. Deducting Rs. 1-8-0 for the cost of spraying the net profit per tree comes to from Rs. 3-8-0 to Rs. 5-8-0. This is an exceedingly valuable result particularly to the owners or dealers of grafted trees.

Besides the above experiment, spraying was done on 200 trees owned by 15 gardeners for demonstration purposes on behalf of the Ratnagiri District Agricultural Association. The owners are convinced that the spray kills these insects and that it is absolutely harmless to the fruit or the tree. Owing to the generally mild nature of the pest this year the beneficial effect was however sufficiently striking only in a few cases where the pest was bad.

It was also noticed that the hoppers were parasitized by a kind of a parasitic fly and a moth.

Six pests of mango of minor importance were noticed, identified and recorded.

Cocoanut pests.

37. *The black beetle.*—The incidence of attack from month to month was studied. It was noticed that the large grown up trees are very rarely attacked and it is the younger plants which seem to attract this beetle most. The attack continued almost throughout the year except in the months of August and September and January and February, and varied from 10 to 20 per cent. being the most severe in the months of November and December.

Cashew-nut oil which was reported in the annual report of 1919-20 to have been tried casually as a deterrent with some prospects of success did not prove to be so in a systematic experiment.

Other pests.

38. A disease called ' Doda ' on *vari* (panicum milliceum) was brought to notice as causing considerable damage in the Ratnagiri District. The individual grains of the ear-head appear to be swollen up ; and sometimes the whole ear-head itself comes out prematurely, even in the seedling stage, very much reduced and affected with the disease. Inside these hollow enlarged grains pinkish fly maggots are invariably found, which hatch out into pinkish coloured flies. This could not however be further tackled owing to sufficiency of work already in hand.

SOME SPECIAL PROBLEMS UNDER INVESTIGATION.

39. *Improvement of Manat Lands in the North Konkan.*—Burning of such lands which was given a systematic trial confirms the casual observations made in past years ; it has created far more favourable conditions for the plant growth with the result that substantially increased outturns are obtained. Of all the methods of improvement tried so far burning is thus the only one which may be expected to give useful results, though the practicability of finding so much burning material would be problematical.

As regards the suitability of crops to the *manat* conditions, in addition to *shalu jowar* as a *rabi* crop and almost any irrigated crop, cotton continues to be promising, though it has not been possible to obtain a good stand of the crop owing to the uncertainty of the soil and climatic conditions at the time of sowing ; Borbon variety seems to be more suitable than others so far tried ; it has also been found that cotton plants can be established by cuttings planted at the beginning of the monsoon. Safflower was tried and has also been found to be promising.

When the soil is burnt, *kharif jowar*, groundnut, *bhendi*, vegetable, *tur* and *ambadi* have been found to suit the *manat* conditions so as to give remunerative outturns.

40. *Wilt disease of onion.*—The Plant Pathologist of the Department has taken up the investigations of this disease and remedial measure for the same. Our trials of different varieties show that the crop from Gokak seed is the most susceptible while that from Goa seed is the most resistant.

NEEDS AND DIFFICULTIES OF AGRICULTURISTS.

41. Those that came to notice during the year in addition to those recorded in the previous reports are as follows :—

(1) Improving the quality of well waters in the garden belt on the coast of the Alibag Taluka of the Kolaba District, which recently get brakish in the fair season.

(2) Preservation of sweet potato tubers from spoiling by a beetle.

(3) Remedial measures against the bleeding disease of cocoanut.

Extension Work.

42. This consists in bringing agricultural improvements to the notice and into the practice of agriculturists and giving such advice and help as will make the agricultural industry in general more profitable. This work is principally carried on through the itinerant district staff who are called Agricultural Overseers assisted by *Kamgars*. The agricultural stations also serve as standing centres of demonstration or as centres for distributing improved seed, manures and implements.

The work in the Thana District had to be suspended as the incumbent of the post of the Agricultural Overseer had to proceed on long leave owing to ill-health and no trained substitute was available. The work in other districts has continued unhindered by any such circumstances. A new charge comprising Mundgod Peta and Halyal Taluka, and representing the very eastern belt of Kanara with low rainfall has been separated out in the Kanara District with an Agricultural Graduate for a demonstrator and a Demonstration Farm at Mundgod.

POPULARIZATION AND INTRODUCTION OF AGRICULTURAL IMPROVEMENTS.

43. To briefly summarize the important results of extension activities during the year, Kanara District which has presented better scope for improvements and where work has been carried sufficiently long without a break in the personnel has continued to occupy the first and far ahead rank in point of substantial progress. Ratnagiri District with its communications blocked in the monsoon (*i.e.*, the time for most demonstrational work) comes next though far below. Thana and Kolaba districts owing to repeated breaks in continuity come last.

The detailed results and the situation as obtained during the year with regard to the several items of propaganda are reviewed below district by district.

Kanara District.

44. For special reasons to be described elsewhere, a new charge comprising the very eastern belt of the district consisting of the Mundgod Peta and the Halyal Taluka has been separated out under the charge of another Graduate with a block of four or five cultivators' farms worked as a Demonstration Centre.

The rest and bulk of the district remained in the charge of one Graduate Overseer assisted by one permanent *Kamgar* and three temporary ones, Government having refused to sanction the latter posts permanently owing to the general financial stress. The aportioning of the area amongst the four *Kamgars* was the same as last year, namely, (1) Karwar Taluka, (2) Ankola-Kumta, (3) Honawar-Bhatkal and (4) Sirsi-Yellapur-Siddapur. The incumbents of all the *Kamgars'* posts except that of Sirsi circle in which changes of personnel had to be made, having now received a fair amount of training and experience during the two years since they were made available, good impression of the propaganda work is now being made on the agriculturists. The total suspension of the three temporary posts for the two months April and May put a set back to the progress of work by nearly 25 per cent.

It was found possible to increase the number of centres through which work was carried on by 10 over the previous year while three in the Mundgod peta and Halyal Taluka were omitted owing to the separation of that charge, thus the list stood at 32 distributed as follows:—

Karwar Taluka.—(1) Bad, (2) Arge, (3) Halga, (4) Chitakuli, (5) Kadra, (6) Majali.
Ankola Taluka.—(7) Ankola, (8) Avarsa, (9) Andle, (10) Gundbale.
Kumta Taluka.—(11) Torke, (12) Hiregutti, (13) Gokarn, (14) Hegde, (15) Uppinpattan.
Honawar Taluka.—(16) Karki, (17) Chandavar, (18) Manki, (19) Haigund, (20) Samsi.
Bhatkal Peta.—(21) Balkur, (22) Murdeshwar, (23) Bhatkal.
Sirsi Taluka.—(24) Sirsi, (25) Islur, (26) Kananalli, (27) Bandal.
Yellapur Taluka.—(28) Idgunji, (29) Yellapur.
Siddapur Taluka.—(30) Bilgi, (31) Killar, (32) Siddapur.

The Agricultural Overseer toured on 215 days of the year and the *Kamgars* on an average the same ; in all 122 villages were visited about 1,000 persons were approached out of whom nearly 400 were new. About 400 out of the total and 200 of the new have either adopted or are likely to adopt some improvement or other.

The various items in which propaganda operations were conducted together with the progress achieved under each are summarised below :—

Bone manure for rice.—Propaganda work in this was commenced in the year 1919. During the year of report this was demonstrated at 17 centres on 25 plots as against 8 of last year. At almost all the places in the coastal division both on sandy and laterite soils, the past experience of an increase in outturn by 25 to 50 per cent. working at a net profit at Rs. 15 to 22 per acre after meeting the cost of Rs. 10 for manure were repeated. Most of the cultivators on whose fields this was given for demonstration as also some of the neighbourhood who had seen the crop have come forward, in all 90, to purchase their own quantity which is estimated to go to six tons as against four of the previous year. In some quarters there are apprehensions spread that the extended popularity of bone-meal and artificial manures is likely to lead to the cutting short of the privileges for leaf manures from the forests.

Maskati variety of rice for uplands.—Bringing the advantages of this variety to the notice of the agriculturists was commenced in the year 1919-20. During this year, 28 cultivators at 13 centres, as against four of last year were induced to give it a trial ; at seven of the 13 centres, the results giving an increase of 15 to 20 per cent. have made a good impression and the cultivators have preserved a large stock of the outturn for use as seed next year, and it is expected that about 50 persons will have an area of about 50 acres under this variety.

Mass selected seed for rice.—The results of the Kumta farm having conclusively proved that mass selected seed gives a profit of Rs. 10 to 15 per acre at practically no cost, this item was taken up for propaganda work since this year. The method of selection was demonstrated at four places and 200 lbs. of selected seed has been obtained and preserved for sowing and demonstration of results in the next rice growing season.

Red Mauritius variety of sugarcane.—The popularization of this variety which was commenced in the year 1911-12 went ahead this year, the increase being estimated at 145 acres in the whole district. The rapid progress in Karwar Taluka, which has been taken up since the last two years only has been maintained. In the above *ghat* talukas it has been found that this variety is very much suitable for ratooning over a succession of years with as much as or even more yields than the plant cane—a distinct merit which is much prized in that locality where the difficulties of labour and of enclosing the sugarcane fields against wild pigs are great.

Poona furnace and pans for boiling sugarcane juice into gul.—This improvement which was taken up for introduction in the year 1912 has now taken a firm hold in places which have been sufficiently persisted in. The furnaces that were built last year were all continued and new ones built in their neighbourhood. The hirers of the Poona pans were also explained how their pans would have their life extended if they were to insist on the use of the Poona furnace by their clients. Both the users and hirers of pans are coming gradually to realize the advantages of the Poona furnace.

As regards Poona pans, they were demonstrated at 14 new places. The appreciation of its advantages would be seen by a continuous demand for them every year ; this year 28 pans, *i.e.*, about the same number as last year were bought. It should be pointed out here that the bulk of sugarcane cultivators are tenants cultivating only a few *gunthas* each and cannot therefore afford to buy their own pans and mills. It is therefore the moneyed men who do the business of supplying those on hire. The latter have already their old copper pans which they have no

interest in scrapping, and buying improved pans. It is thus through the purchases of new pans that this improvement is to go forward.

One special feature of the introduction of Poona pans is that the local craft at Kumta has been induced to manufacture Poona pans at Poona price which is a distinct advantage in that it saves the cost, trouble, and delay involved in obtaining these from Poona. Two copper pans were also newly made after the Poona pattern and two of the old copper pans were similarly converted.

Improved sugarcane mills.—There is no need now to preach and demonstrate the advantages of iron crushers, which have now almost ousted out the wooden crushers. A sufficient supply of them of one type or another is now being maintained on hire by the village business men and the work of the Department now consists in advising any purchasers of new ones about the best type and make and in helping the users about their proper erection and adjustment, of whom latter about 1,000 were dealt with.

The scope for a power-crusher at one or two centres along the Honawar-Gersappa and Kadra-Kodibag creeks was mentioned in the last year's report. Efforts were made during the year to sound and stimulate local and co-operative enterprise but it was found that sufficient confidence could not be created amongst the people without an actual instance first which they expect Government to furnish.

A wider distance between the rows of sugarcane.—This has been taken up for demonstration since the year 1919-20 with a view to bring about a saving in the number of sets used and to see if possible whether labour saving implements cannot be used. During this year 11 new sugarcane growers at 6 places were with great difficulty persuaded to plant about a *guntha* each. As expected however the resulting crops totally removed the misgiving and it is estimated that about 50 persons in and round about the places in Karwar Taluka where it was demonstrated for the first time and about one-fourth the number of cultivators of Red Mauritius variety in the Honawar Taluka where this was the second year of its demonstration, are likely to adopt the wider planting.

Use of concentrated manures for sugarcane.—This was not known to the people ; even what little quantity of *undi*-cake is locally available was used for burning ; fish manure obtained all along the coast was exported by outsiders. The demonstration of the profits by the use of concentrates was therefore taken up since the year 1919 with fish manure to start. In the year of report five plots each for *undi*-cake and fish manure and one plot for sulphate of ammonia at places which were new were provided. In almost every place the manured crop was outstandingly superior and created a favourable impression on the owners and visitors of the plots ; one somewhat disquieting feature of the demonstration was that in two or three places the crops having grown so well and fast attracted the attention of and constant damage by wild pigs even before the general crop, which has created a sort of fear against the use of concentrates in those places. Barring this accidental incidence, the people have begun to feel the marked advantages from the use of concentrates. Fish manure continuing to be dear and scarce has not however been adopted to any extent, but a tendency towards using *undi*-cake is distinct.

Vari.—With a very striking success obtained on the Kumta farm for this as a *varkas* land crop, it was taken for popularization since the year 1920. The trial of this by some *kumri* cultivators in Honawar Taluka the first year created considerable interest, and though the crop has kept on there is no further demand for seed. During the year of report it was demonstrated at four places in Karwar Taluka where it has been liked and is likely to extend to 10 to 12 places next year.

Onion.—This item is under demonstration since the year 1914. This new crop has become a routine round about Kumta and does not require any propaganda there. Operations have also been extended to other localities, where its firm establishment is faltering on account of the wilt disease having synchronised with the young stage of introduction. The interest in the new centres had therefore slackened with the result that only 160 lbs. of seed could be disposed of as against 340 lbs. of last year. During the year of report the disease however appeared late and the crops that were obtained are again likely to revive the interest. Last year's forecast about the Karwar Taluka has come out to be true by the fact that from three growers of the last year the crop could be extended to 26 and the success of this year is sure to lead to as rapid extension next year.

Last year's observation that Goa seed is more resistent to the wilt disease was again confirmed this year, and attempts have been made to start raising of seed locally. The rate in Goa itself is very dear and it is besides extremely difficult to procure seed from there. The seed from Gokak which has been in use in recent years has been found to be the most susceptible to wilt in comparative trials.

As for sugarcane, so for any other crop, whether profitable garden or otherwise ; no concentrated manures are ever used. Fish manure had been demonstrated in the past and its value has been realized by established growers ; but fish manure has become very dear and

scarce ; so the use of *undi*-cake was demonstrated at 3 places and as expected convinced the owners and visitors of the plots, and it is expected that these persons would benefit by this experience to the extent of the available quantity of the cake. Nitrate of soda was also demonstrated at one place with remarkable success.

Tobacco.—This crop which is grown very successfully in South Kanara as a source of cash income is altogether unknown in the adjoining district of North Kanara where soil and climatic conditions are almost similar. The crop having therefore been given a trial for two seasons and found thoroughly successful on the Kumta farm has been taken up for demonstration since the year under report. A few leading cultivators at six places were induced to give a trial on a very small scale the first year. The crops fared fairly well but as the Kamgars were withdrawn at the time of its curing, they could not be demonstrated. Still the possibilities of the crop have been sufficiently impressed on these persons so as to repeat the trial next year on somewhat a larger scale.

Guinea grass.—The demonstration of this as a fodder crop to be grown in gardens was commenced this year at six places. The sets have established well and the owners are wishing to increase the number of plants from the increased supply of sets obtained from the first planting.

Meston plough.—This has been under demonstration since 1911. This year 31 places had the benefit of demonstration, as against 15 of the previous year. Better kinds of animals and absence of very striking advantages continue to be the limiting factors. The sale during the year amounted to 26 ploughs as against 54 of the previous year.

Improved rice land puddler.—The demonstration of this which was commenced since the year 1921 was continued this year, the places being 11 as against 6 of the previous year. Though the puddling was satisfactorily done at all the places except the sandy fields, it was found that the implement draws a bit hard especially to the weaker sort of draft cattle. Five of the stock maintained were sold.

Value of undi-cake as a manure instead of fuel.—The value of this as manure has been under demonstration to the agriculturists for some time and they have been now made alive to the same ; but the oil-mongers have been using it as a fuel and it has been a hard job to persuade them to stop that practice and make it available for manure. So the matter of convincing the latter about the profits in selling it as a manure instead of burning was taken up and there are very hopeful prospects of success. During the year of report appreciable quantities have been collected by cultivators for manure for sugarcane, cocoanuts, rice seed-beds, etc.

Pig-proof woven wire fence.—In the last year's report, commencement of demonstrations in five different places in the district has been referred to. Owing to dissensions in the co-operative society at Halga, taluka Karwar, the fencing intended for the society was not availed of ; it has therefore been transferred to a land owner at Kadra who is anxious to try it. At all other places it has convinced the users and other visitors that it can really keep out pigs, and people have offered to pay some hire for being allowed its use. Three substantial land-owning cultivators, having known of the good results have bought some fence of this type. Conditions seem to be hardly favourable for the tenant cultivators who form the bulk of the actual tillers of the soil in Kanara to use this fence on their own account either individually or on co-operative basis and it must be the owners who must provide this amenity to their tenants for which they may charge them extra rent.

45. *Demonstration work in Mundgod.*—Mr. L. J. Mountford, I.C.S., Commissioner of the Southern Division, brought to the notice of the Director of Agriculture in the year 1920 a request from cultivators of Mundgod peta that a demonstration farm be established in that peta where the Government would know at first hand the difficulties of the cultivators and would be able to find and be in a position to rightly advise about the agricultural improvements.

The situation is briefly this : The lands are fertile with about 50 inches of rainfall and a number of irrigation tanks. But the population which is entirely of agriculturists is declining fast of late, there being a reduction of 30 per cent. in the census of 1921 over that of 1911. Cultivation of lands is being relinquished so that at present about three-fourth of the total area that was once cultivated is lying fallow. Government forests occupy 77·7 per cent. of the total land of the peta and malaria is said to be on an increase. Amongst the several causes which have brought about such conditions and particularly in the decline of cultivation with which the Agricultural Department is more concerned, the increased devastation of crops by wild pigs is one of great importance. Cultivators use a fence made out of bamboos, but it is not quite effective and notwithstanding the watching in addition to the fencing the damage is considerable. Besides bamboos are not always available near at hand and it therefore involves a lot of labour which is already being scarce. A practical solution of this difficulty is calculated to give an impetus to stimulate increased cultivation and cultivation of more remunerative crops for which physical conditions are very favourable. The conditions described above are not peculiar to Mundgod peta alone, but also apply to a more or less extent, to all the tract of Kanara, Dharwar and Belgaum districts lying in the transition zone between the mountainous heavy rainfall belt of the Sahyadris on the west and the black soil plains on the east.

The Director of Agriculture therefore sanctioned the establishment of a demonstration farm at Mundgod. This farm is however quite a departure from any that have been established by the Agricultural Department in the past. In the first place, it is exclusively a demonstration farm; and in order to work under cultivators' own conditions and difficulties as against an advantaged position of an entirely Government institution, and to tax the public funds to the minimum, a block of one or more cultivators' area is taken; all ordinary operations and expenditure is to be done by the owners, and Government only provides an expert to give advice and show the technique of improvements which they are in a position to recommend with a gaurantee that in the event of the cultivators' suffering loss on account of the improvements it should be made up by Government. If any of the improvements recommended involves a large expenditure which they are unable to find, such items are to be financed by Government in the first instance and the cost recouped from the net profits to be accrued by the cultivators therefrom.

A block of land representative of all the conditions met within this tract, belonging to a substantial agriculturist—one Mr. Ahmedkhan Fatekhan of Mundgod, who showed his willingness to work under conditions mentioned in the foregoing paragraph was therefore selected in October 1921. The first and foremost difficulty to be dealt with, as has been already emphasised above, was that of wild pigs, and so it was decided to test the efficacy of a pig-proof woven wire fence. In the meantime the fence was ordered and arrived on the spot, some fair season vegetables and varieties of sugarcane which are quite new to the tract were grown with the ordinary bamboo fence protection and the construction of a silo for demonstrating the advantages of silage of grass which is abundant in this tract, were undertaken. Out of the vegetables grown, *guvar*, radish and onions did well and made a favourable impression on the owner and others who saw the crops and the ready money realised in the local market. Maize, *bhendi* and *dodka* also fared moderately well on a very small scale; Poona pan for boiling sugarcane juice, Kirlosker iron plough No. 12 and the Sabul plough for ploughing and ridging for sugarcane were also demonstrated. Rice seed was also selected for sowing in the next year.

Destruction of wild pigs by poisoning at various places was also tried. Both arsenic and strychnine poisons were used and it was found that a two grain dose of strychnine incorporated in a bait of a ball made out of fried bran, rice flour and *gul* one tola each was more effective than arsenic. It was noticed that a field which was visited by a herd of 40 to 50 animals before the poisoning was done has not been visited for the last four months (up to the time of this report).

The pig-proof wire fence arrived in April 1922. But from the actual experience gained during the period of six months, it was found that the owner of the plot selected had more interest in forest contracts, and did not so much mind his argriculture. He did not care to carry out operations according to the advice of the Agricultural Demonstrator located there, and the irrigation tank commanding his area was not found to actually contain as sufficient water as we were given to understand. The plot had therefore to be changed. The new plot is composed of a block of land 32 acres in extent representing all the conditions and commanded by an irrigation tank with a sufficient and sure water supply and belonging to four cultivators, whose sole business is cultivation, which they are carrying on themselves. The pig proof fencing has been erected round this new area, and a programme of improvements to be demonstrated drawn up.

Ratnagiri District.

46. This district had one Graduate Overseer assisted by one permanent and one temporary *Kamgar* the latter of whom was withdrawn from the end of March on account of general retrenchment in expenditure. The policy of concentrating work within a manageable area easily accessible was continued. The area and the centres of work in it remained the same as last year, namely :—

Ratnagiri Taluka.—(1) Ratnagiri, (2) Hatkhamba.

Sangmeshwar Taluka.—(3) Devla, (4) Sakharpa, (5) Devrukh.

Devgad Taluka.—(6) Kharepatan.

In all 33 villages were visited and about 500 cultivators were approached in the above centres out of whom 11 villages and about 100 cultivators were new. About 100 of those approached are likely to take to improved agricultural methods, 10 out of whom are the new acquisitions of the year.

The following indicates the various items of improvement on which propaganda work was carried on together with the progress achieved.

Rab substitutes and supplements for rice seed-beds.—Commenced in 1918; the demonstration plots were increased to ten this year as against four of last year. As during the past years, the substitutes or supplements have made up the deficiency of *rab* materials at somewhat less cost than *rab big* when out of pocket expenditure is involved for labour for the latter. It is found that the trouble from weeds is not so serious on the high lying rice fields. Though as a result of those demonstrations four agriculturists carrying on their cultivation with hired labour had recourse to adopting the use of substitutes at their own cost on a small portion of their fields, the need for them does not appear to be sufficiently wide and intense.

Bonemeal for rice.—This is the third year of demonstration of this in which the number of plots was ten as against six of last year, and which gave, as in the past years, an increase of 25 per cent. or more. Ten cultivators have purchased manure for an area of about 20 acres in all.

Fish manure for rice.—Commenced in 1919 this was demonstrated at three places and the same increases in yield as in the previous year, *viz.*, from 30 to 40 per cent. was obtained. Some half a dozen cultivators had a desire to use this manure for the following season, but owing to the prohibitive rise in the price they cancelled their plan.

Sweet-potato as a more profitable new crop on varkas lands.—The demonstration of this commenced in the year 1920, extended over three plots as against one of the previous year. As a result, about 20 cultivators from the neighbourhood of the places of demonstration have taken to this crop on small areas.

Chillies as a more profitable new crop on varkas lands.—In this second year of demonstration, three plots were provided as against one of the previous year. With the exception of one plot which got submerged under water owing to an abnormal rise of floods of the adjoining river, to which the crop succumbed, outturns worth Rs. 150 per acre were obtained and the owners of the successful plots intend to double the area under this crop.

Extension of sugarcane cultivation and introduction of improved methods of cultivation and manufacture.—There is a fair amount of scope for substantially increasing the profits from agriculture in the area under operation. This has therefore occupied a prominent part in the propaganda activities for the last four years. The progress has been from 12 acres of last to 15 acres of this year in which there have been six new persons. It is found that the new growers are not yet convinced that the large profits claimed for sugarcane cannot be expected if they would not follow all the details of cultivation and those too quite timely, and hence they do not carry out all the operations as they are once shown and told to do unless the propaganda staff are constantly after them and get them done in their presence. This combined with the generally very unfavourable economic state of agriculture of this district accounts for the slow progress. The one satisfactory feature of it however is that this crop is slowly catching the fancy of the small labouring cultivators.

Improved methods of cultivation and manufacture which were adopted in the extension of propaganda were also utilized for demonstrating their advantages to the existing and prospective cane growers of the neighbourhood. As a result there has been some awakening to the advantages of these improved methods particularly those of manufacture. There has been more and more demand for the improved appliances on hire and the Kharepatan Implement Hire Co-operative Society which was established last year did good business and is thinking of increasing its stock ; there have been also some enquiries for purchasing improved crushers and pans.

Onion as a new profitable crop.—This is the third year since this was taken up for demonstration. It was tried at about a dozen places and was successful at all except three where it was affected by the wilt disease. Some (four) of the cultivators are sufficiently convinced to continue the crop on their own account.

Lucerne.—As the earlier results on the Ratnagiri farm showed consistently that this crop could be successfully grown in this district, attempts to grow it under cultivators' conditions have been made during the last three years ; either here or on the Ratnagiri farm the crop has fared very poorly, one of the reasons being the damage by insects in its very young stage.

Spraying remedy against the mango hoppers.—The Entomological Assistant took up on behalf of the Ratnagiri District Agricultural Association the demonstration of this for the first time. Fish oil rosin soap was used. In all 192 trees belonging to 16 persons round about Ratnagiri were sprayed. The pest not being so bad this year, the results were not very conspicuous but the people who have watched the effects have been convinced that the spray kills the insects and that the spraying is absolutely harmless to the development of the fruit or the tree. The beneficial effects were however very strikingly brought home to some few in places where infestation was very bad.

Ensilage.—A pucca silo was built at Hatkhamba from the donation granted by the Sir Sassoon David Trust Fund. Green grass at suitable stage was ensiled. The silage obtained was 60 per cent. of the quantity of green grass put in, out of which about one-sixth was in a spoiled condition. The cost of ensiling came to Re. 1 per 200 lbs. of silage. The silage was fed to five milch animals of four cultivators for trial and demonstration during two of the summer months at the rate of 15 lbs. per animal per day. In all cases it improved the condition of animals remarkably and even increased the milk flow by about 6 ozs. per day, *i.e.*, 7 per cent. of the normal yield, which, apart from the improved condition of the animal effected, is just about equal in value to the extra cost of making the silage. As a result of this demonstration the two substantial cultivators out of the four have a desire created in them to do the silage on their account.

Meston plough.—The demonstration of this was repeated during this year, with no better prospects of its appealing to the cultivators as something which they ought to adopt.

Balsar rahat-water lift.—This which was fixed on a river side at the end of the previous year was worked throughout one full year, but the land owner, who was induced to go in for irrigation farming with the help of this water lift, is not satisfied with what he was able to achieve during the first venture and does not feel confident enough to continue farming. Neither the smaller cultivators of the locality of demonstration showed any desire to go in for irrigation farming if water lifting with this was organised for them.

Kolaba District.

47. It is only during this year after a break of two years that an Agricultural Overseer has worked full time in this district. The *Kamgar* of the Thana district, who was liberated by the suspension of work in that district, was kept at the disposal of the Agricultural Overseer, Kolaba, from December.

In accordance with the recent policy of confining and concentrating propaganda activities in a limited sphere which enables the turning of the resources available to the most advantage, the tract bounded by the Ulhas and the Patalganga river valleys comprising parts of Khalapur peta, Karjat and Panwel talukas of the Kolaba district and Kalyan taluka of the Thana district, which afford the largest opportunity for development owing to a large perennial flow of water running into the rivers from the Tata Hydro-electric Works, was fixed upon with head quarters at Karjat. Work was commenced with four centres (1) Khalapur, (2) Vashivli, along the Patalganga and (3) Karjat and (4) Neral along the Ulhas; (5) for special circumstances demonstration of nitrate of soda on onions was also done in the Alibag taluka. Some propaganda work was also done by the Alibag farm staff in the Alibag taluka.

The Agricultural Overseer toured on 230 days. He visited 38 villages and carried his mission to 125 persons of whom 20 are likely to take one recommendation or another.

The items which specially formed the propaganda activities together with a summary of progress achieved under each are described below :—

Development of irrigation farming along the Patalganga and the Ulhas rivers.—Although a perennial supply of water is flowing in these rivers from the Tata Hydro-electric Works, and the lift is low, no use is yet being made thereof for growing profitable money crops for which there is an excellent market of Bombay near at hand. Bringing the immense possibilities to the notice of cultivators and stimulating them to avail of the same formed the principal item of the programme. The causes for such a state of affairs are briefly summarised in the last year's report. Further enquiries bring out one more cause on the part of tenant cultivators, that the *rab* collecting operations occupy a large part of their fair season time. This though partly true need not deter the propaganda efforts, as rice growers round Panvel, Alibag and along the B. B. & C. I. Railway in the Thana district are carrying on garden cultivation without giving up their rice cultivation.

As a result of last year's efforts there has been some awakening. The only plots already under systematic cultivation before the Department took up this propaganda were two—one at Vashivli of a Panvel Mali and the other at Karjat of an enterprising Brahmin cultivator from Thana ; besides the above there were groups of a few brinjal plants at suitable places along the two rivers all watered in head-loads. During the year, three or four cultivators from Vashivli who had gained some confidence by working as labourers on the plantation of the Panwel Mali working in their village for the last seven years, and one Panwel Mali newly come to Karada along the Patalganga, and three local land-owners round Karjat and four Panwel malis at different points, along the Ulhas, took up to garden cultivation for the first time. Thus the total area under garden crops along the two rivers is estimated to have been 56 acres as against 15 of the last year.

To infuse confidence and to induce more people to go in for this farming and to encourage those who have already taken to it, a party consisting of ten cultivators was taken to centres of garden cultivation along the B. B. & C. I. Railway in the Thana district. The crops grown, their methods of cultivation, manuring and the labour saving implements of cultivation recently introduced there by the Agricultural Department, and the large profits which the gardeners are making were brought to their notice. This demonstration seems to have produced desirable effect on the visitors forming the party.

Government is also considering the stimulation of irrigation farming on these waters by way of providing demonstration centres by subsidizing some private efforts of cultivation.

Mass selection of seed in rice.—Owing to late return of the Agricultural Overseer from famine duty it was not possible to undertake the demonstrations of any improvements in the rice crop except that of inducing two cultivators to select their rice seed and preserve it for comparative trial during the following year. Alibag farm selected about three tons of seed out of its produce which was very readily purchased by the cultivators of the neighbourhood.

Bonemeal and fish manure for rice.—This was demonstrated by the Alibag farm staff on one cultivator's field of the neighbourhood. The owner and others who were called to witness the crop acknowledged the superiority of the manured plots which amounted to about 15 per cent. in actual yields.

Nitrate of soda on onions.—This has been found to be a very profitable source of manuring onion in the experiments carried on the Alibag farm. Alibag taluka being the only locality in

the Kolaba district where onion is largely grown, demonstrations were arranged there on sixteen cultivators' plots in three villages. In all the plots it gave good results, which were quite obvious to the eye of the cultivators. In one plot which was made a place of a demonstration to other onion growers of the neighbourhood, the crops with nitrate of soda and with the local manure of fish were separately harvested in the presence of the visitors, and the one with nitrate of soda gave an extra yield worth Rs. 80 per acre or 11 per cent. more as compared with the local manure. The advantage in cost was still more. Two cwts. of nitrate of soda which was given and produced the above result cost Rs. 32, whereas the 1,600 lbs. of fish manure which the cultivator used had cost him Rs. 90 per acre, giving a net gain of Rs. 58 per acre in favour of nitrate of soda. The cultivators seemed to be well convinced with these results, though the false notion that nitrate of soda requires more water than fish could not be removed from their minds without a concrete living instance before their eyes. This last would be arranged for in the future programme.

Sulphate of Ammonia to Garden Crops.—As fish manure is getting scarce and dear, the use of sulphate of ammonia was advocated for chillies at Karjat and for *tondli* (a small cucurbit), vines at Chondhi near Alibag. It was found successful and profitable at both the places.

Thana District.

48. The Graduate Overseer who was in charge of the propaganda work in this district proceeded on long leave from September. The post remained vacant till March 1922 when one Mr. Sakhalkar, a raw graduate, was available; he has been in training during the rest of the year. The *Kamgar* who cannot be of any use without close direction and supervision was kept at the disposal of the Agricultural Overseer, Kolaba. There was thus no progress in the work during the year.

EXHIBITIONS, DEMONSTRATIONS AND SHOWS.

49. There was one agricultural exhibition and demonstration arranged at Kalyan in the month of May in connection with the session of the Maratha Educational Conference held at that place. The full programme could not however be carried out owing to the sad news of the sudden death of His Highness the Maharaja of Kolhapur. Still the exhibits were seen by about 1,000 visitors.

50. Besides the large number of local demonstrations that were given by the Agricultural Overseers in connection with the propaganda work described under respective districts above comprehensive central demonstrations to show the several improvements in actual operation on the Government farms were organised by calling parties of cultivators from the districts, at the two farms—Ratnagiri and Kumta—in the month of September. At Ratnagiri, it was this year the turn of Devgad, Malvan and Vengurla talukas and although all arrangements were provided on two occasions, owing to sudden rough weather and dislocation of steamer service none from those talukas could come; there were however about 30 visitors from the neighbourhood for whom the full programme was gone through. At Kumta, however, it came out to be successful; all the talukas except Halyal and Yellapur were invited and contributed in all the full number of 100 visitors arranged for, the coastal talukas and Kumta amongst the latter having shared larger proportions. A good many of the visitors took a keen interest in what was shown and explained to them and must have carried with them favourable impressions; at any rate they have been made fully alive to the successful work that the Agricultural Department is carrying out for them, and as such are likely to be useful as basis for pushing on propaganda work.

SUPPLY OF IMPLEMENTS, MANURES, SEEDS AND OTHER ARTICLES TO ORDER.

51. In order to meet the orders which are created as a result of the propoganda work all the three agricultural stations were made the principal agencies for obtaining, stocking and distributing the necessary articles until co-operative societies and private agencies think it worthwhile to take up such business. The following statement represents the business of the year:—

Kind of article.		Alibag farm and Agricultural Overseer, Karjat.	Ratnagiri Farm.	Kumta Farm.	Arranged to be supplied direct from dealers without the intervention of foregoing agencies.	Total.
Seeds.						
Groundnut ..	Lbs.	....	13	280	564	857
Mango grafts ..	Nos.	....	....	....	680	680
Onion seed ..	Lbs.	....	....	145	....	145
Paddy ..	Lbs.	502	319	1,600	....	2,421
Sugarcane sets for acres ..		....	1	....	30	31
Manures.						
Bone meal. ..	Lbs.	20,203	2,379	13,026	....	35,680
Fish manure ..	Lbs.	....	....	3,474	....	3,474
Nitrate of soda ..	Lbs.	....	....	....	848	848
Sulphate of ammonia ..	Lbs.	160	....	....	....	160

Kind of article.		Alibag farm and Agricultural Overseer, Karjat.	Ratnagiri Farm.	Kumta Farm.	Arranged to be supplied direct from dealers without the intervention of foregoing agencies.	Total.
Implements.						
Bulsar rahat water lift Iron leveller	Nos.	1	....	....	1	1
Iron ploughs and spare parts..	,,	22	2	15	....	39
Poona pans ..	,,	....	....	2	34	36
Sugarcane crusher ..	,,	....	....	1	5	6
Tooth cultivators ..	,,	....	....	5	....	5
Other articles.						
Wire-fence rolls ..	Furlongs.	....	....	....	7	7

Besides the above, small quantities of various kinds of seeds such as *vari*, *chiku* seedlings, sweet-potatoes seed vines, cocoanut seedlings, cotton seed, bamboo seed, vegetable seeds, *shevari* seed, cotton seed cake for feeding cattle and strychnine poison were also supplied to orders.

Denaturalised Salt for Manure.—The arrangements to supply denaturalised salt for manurial purposes duty-free were continued. As there was a keen demand for supply of salt in October, November, and certain places on the coast, which have no fish-curing yards or salt works close by but have Customs establishment, requested for arrangements to issue salt from the Customs establishments, the Commissioner of Customs and Salt was approached and has sanctioned a second issue of salt in November and the other facilities mentioned above. The price of salt was fixed at Rs. 1-2-0 per maund. This is considered by the agriculturists too high to be sufficiently profitable. The number of permits issued together with the total quantity of salt for each district during the year under report is given in the following statement :—

Period.	Thana district.		Kolaba district.		Ratnagiri district.		Kanara district.	
	Number of permits.	quantity issued.	Number of permits	Quantity issued.	Number of permits.	Quantity issued.	Number of permits.	Quantity issued.
November issue ..	1	20	1	80	39	1,101	8	73
April-May issue ..	5	117	1	80	13	218	43	478
Total for the year 1921-22.	6	137	2	160	52	1,319	51	551
Total for the year 1920-21.	12	362	7	120	45	709	63	637

PUBLICATIONS.

52. Leaflets on the following subjects were drawn up :—

(1) Tobacco in Kanara district.
(2) Green manuring of *nagli* with *san*.
(3) Cultivation of hill paddy on *varkas* lands.

The translation of the " Book of the Mango " into Marathi has been taken up by Mr. V. R. Sabnis, Agricultural Overseer, Ratnagiri.

Notes and articles were contributed to the various Agricultural magazines by the members of the staff of which the principal ones are mentioned below :—

	Name of Author.	Where published.
(1) Monthly notes of agricultural operations for each of the four districts.	Deputy Director of Agriculture, Konkan, assisted by the Farm Superintendents and Agricultural Overseers.	*Shetki* and *Shetkari* and *Konkan Shetki Samachar* and *Vakkaliganoo Vakkalatanavoo.*
(2) Note on *jowar* ..	Do. ..	In connection with the revision of Mollison's Text Book of Indian Agriculture.
(3) The past of Indian Agriculture and the need of improvement.	Mr. V. L. Bhoseker, Superintendent, Ratnagiri Farm.	*Konkan Sheti Samachar.*
(4) Cultivation of san hemp by the Devgad Taluka of the Ratnagiri District.	Mr. K. B. Gujar, Agricultural Investigator, Alibag.	Poona Agricultural College Magazine and *Konkan Sheti Samachar.*
(5) The Mundgod Demonstration Farm.	Mr. G. B. Pandit, Agricultural Demonstrator, Mundgod Demonstration Farm.	*Vakkaliganoo Vakkalanavoo.*
(6) Co-operation in protection of crops from wild animals.	Do. ..	*Konkan Sheti Samachar.*
(7) Stone wall fence ..	Do. ..	Do.

——	Name of Author.	Where published.
(8). Rice swarming caterpillar in Konkan.	Mr. P. W. Wagle, Entomological Assistant, Konkan.	Poona Agricultural College Magazine *Shetki* and *Shetkari* and *Konkan Sheti Samachar.*
(9) Crow and its work in Nature.	Do. ..	*Konkan Sheti Smaachar.*
(10) Six monthly progress of the propaganda work in the Ratnagiri District.	Mr. V.R. Sabnis, Agricultural Overseer, Ratnagiri.	Do.
(11) Poisoning of wild animals ..	Do. ..	Do.
12) A case of curious malformation of brinjals.	Mr. N. V. Hanmante, Agricultural Overseer, Kolaba.	Poona Agricultural College Magazine.
(13) Orange cultivation in Konkan.	Do. ..	*Konkan Sheti Samachar.*
(14) Tondli cultivation in Konkan.	Do. ..	Do.
(15) Experience of prickly pear as an emergency fodder for cattle.	Mr. N. V. Hanmante, Agricultural Overseer, Kolaba.	Agricultural Journal of India.
(16) The improved rice puddler ..	Mr. M. R. Gokarn, Agricultural Overseer, Kanara.	Poona Agricultural College Magazine.
(17) A cheap and simple sack holder	Do. ..	Do.

Besides the above, about thirty abstracts and adaptations of matter published elsewhere were contributed to the *Konkan Sheti Samachar* by the various members.

The Konkan Agricultural Magazine.—The Monthly magazine in Marathi devoted exclusively to Konkan Agriculture under the name '*Konkan Sheti Samachar*' as conducted by Mr. Y. G. Gujar of Alibag continued to be extremely irregular in publication. With his permission it has therefore been made over from November 1921 to Mr. D. H. Limaye, B.A., LL.B., the proprietor of *Satya Shodhak* Press at Ratnagiri as a publisher, the Agricultural Department furnishing all the matter. Mr. V. L. Bhosekar, Superintendent, Ratnagiri Farm, has very kindly accepted the editorship and the magazine is being published fairly regularly now. Mr. Bhosekar merits thanks for the responsibility and ability with which he is editing this popular organ.

AGRICULTURAL ASSOCIATIONS.

53. All the eleven associations continued to be on the list, though with the exception of two or three, all of them continue to be defunct. None of them except the Ratnagiri District Agricultural Association have even responded to the call for their reports of activities. On the whole there is a general apathy and lack of leaders for this kind of public activity. The Ratnagiri District Association have elected Mr. V. G. Gokhale, Deputy Director of Agriculture, Konkan, as the Chairman of the Managing Committee of the Association and have directed that the Chairman should be the chief executive officer. From the year under report, the Sangmeshwar Taluka branch of the Ratnagiri District Association and Sirsi and Honawar Taluka Agricultural Improvement Committees in the Kanara District have been taken up by the respective Agricultural Overseers with a view to see if more interest can be infused in the local efforts after some actual work is shown to the credit of the Associations ; for this purpose all the propaganda activities that the Overseers are carrying on in the respective areas as their ordinary duties in the capacity of a member of the Agricultural Department are done in the name of Local Associations. The summary of work in the name of these Associations is as follows :—

The chief function of the Ratnagiri District Agricultural Association consisted in stimulating and directing work through its taluka branches. Besides this, organising a mango show and conference, demonstrating spraying against mango hoppers, taking part in the Provincial Agricultural Conference, and considering whether any of the taluka areas are ripe for the formation of local bodies for Agricultural Department under the new Government Scheme were the most important of the activities of the District body itself. The experienced non-graduate fieldman who was so kindly supplied by the Director of Agriculture at Government cost was attached to Chiplun Taluka as a demonstrator, who having joined in June carried on demonstration of bone-manure on rice, of Meston plough and general agricultural propaganda uptill December when owing to ill health he went on long leave ; many of the bone-manure plots were successful, and considering the difficulties of propaganda work particularly in the initial stages in a new tract, the results were not so bad as to lose all hopes. Sangmeshwar Taluka continued to popularize improved appliances for sugarcane cultivation besides the propaganda activities by the Agricultural Overseer of the Department. Ratnagiri Taluka may be said to be the only one in which some useful work, little though it may be, has been done on its own initiative. Dapoli and Khed showed signs of existence, while other talukas did not even do that.

Though no official reports are received from the Sirsi and Honawar Taluka Agricultural Improvement Committees in the Kanara District, the Departmental Overseer of the district who is working on their behalf has reported as follows : Sirsi Improvement Committee continued the spread of the use of improved sugarcane mill and Poona pans by keeping them on hire and of the Red Mauritius and other improved varieties of cane by supplying seed sets from its demonstration farm ; it recommended the grant of gun licenses and arranged for supply of guns and ammunition and poison for destroying wild pigs damaging the crops. The Honawar

Committee continued the spread of Red Mauritius variety of sugarcane, demonstrating of pig-proof wire fence, the village shikaris for protecting crops from wild animals, and the assistance in getting over the difficulties of agriculturists in getting gun licenses, materials for fencing and in arbitration for securing clearer understanding between the forest authorities on the one hand and the agriculturists on the other.

AGRICULTURAL CO-OPERATION.

54. The agricultural propaganda staff are always on the lookout for stimulating co-operative effort in matters agricultural, wherever conditions might be favourable. In the Kolaba District, the Agricultural Overseer considers that there is scope for organising fish manure supply amongst the garden cultivators round Panvel. In the Ratnagiri District the Kharepatan Implement Hire Society has made a good business in the first year of its inception and is desirous of doubling its stock of implements. In the Kanara District, the Halga Implement Hire Society has continued, but it is learnt that owing to communal dissentions its working has not been quite smooth; the Agricultural Overseer hopes that Hiregutti Manki, Hegde and Murdeshwar would shortly be ready for Implement Hire Societies.

Agricultural Education.

55. Both the vernacular (Marathi) Agricultural schools;

(1) Jambul, taluka Kalyan, district Thana;

(2) Lord Willingdon Agricultural School at Alibag, district Kolaba;

continued to be run during the year.

56. *Studentship and Progress.*—The standard for admission in respect of age or educational qualifications has remained the same as in the previous year. The total number of boys in the two schools at the end of the last year was as follows :—

Name of School.	First year.	Second	Total.	Remarks.
Jambul School ..	20	9	29	In all 31 applications were received all of whom being eligible were admitted but only 22 actually joined the school; 5 out of these subsequently left owing to some reason or other; 3 out of 4 boys who had failed last year first year examination continued again this year. In the second year there were 9 boys all of whom had been promoted from first year.
Lord Willingdon Agricultural School, Alibag.	8	4	12	In all 15 applications were received out of whom 10 were admitted but 8 joined this school and the remaining 2 joined the Jambul School.

These were derived from the following districts :—

——	Thana, Bombay.	Kolaba including Janjira State.	Ratnagiri.	Outside Konkan.	Total.
Jambul ..	17	2	1	9	29
Alibag	....	2	4	2	8

Arranged according to caste they stand as follows :—

Caste.	Jambul.	Alibag.
Marathas	11	..
Agris	1	..
Brahmins	17	12
Total ..	29	12

The number of fresh students at Jambul is more by seven this year than that of the last year and has reached the maximum that is provided for, while that at Veshvi which is 8 as against 5 of last year inspite of some special propaganda in recruiting that was carried on, is still very short and disappointing.

Another favourable feature in the new admissions at Jambul is the increasing proportion of boys from farming communities.

There has been no change in the curriculum during the year. The boys seem to take more interest in the working of the oil engine, in the cultivation of garden crops and in work-shop practice than the routine operations of common farming.

The boys were examined at the end of the School year in April 1922 with the following result :—

Name of School and class.	No. of students that appeared for the examination.	No. of students that passed in all the subjects.	Remarks showing the degree of proficiency in general.
Jambul.			
Second year	9	6	Agriculture, theory and practice, land measurement fair. Nature study and other subjects good and language very good.
First year	20	14	All subjects only fair except workshop practice which is good.
Alibag.			
Second year ..	4	3	Agriculture, theory and practice, workshop practice, language and rural life good ; surveying poor, other subjects fair.
First year	8	8	Arithmetic and language very good ; workshop practice good, agriculture, theory and practice and nature study fair to good ,agricultural geography and rural life poor.

The examiners, Mr. K. M. Powar, Inspector of Agricultural Schools, and Mr. N. V. Hanmante, Agricultural Overseer, Kolaba, make the following observations :—

Mr. K. M. Powar.—" On the whole I found the boys (of the Jambul School) rather weak in practical agriculture and surveying. As regards other subjects the progress is fair."

Mr. N. V. Hanmante. " *Jambul School.*—I found boys of both the years somewhat weak in nature study ; some of them fared hopelessly bad in arithmetic."

" *Veshvi School.*—The boys were well coached in agriculture ; the essay writing was very good ; the students of both the years did not impress much about the subject of nature study."

57. *Cost of Education.*—The total expenditure of the two schools classified under the main heads was as follows : the previous year's figures are also given for comparison :—

	Jambul School.		Lord Willingdon Agricultural School, Alibag.	
	1921-22.	1920-21.	1921-22.	1920-21.
Number of students	29	19	12	12
Teaching Establishment	4,546	3,367	3,100	3,257
Maintenance charges for students	4,982	4,381	2,722	2,767
Other Contingent Expenditure.				
Capital	3,750	9,853	2,315	2,290
Recurring (School farm, stationery and workshop materials for teaching and office miscellaneous).. ..	2,770	2,710	2,028	1,634
Total ..	16,048	20,311	10,165	9,948

The above includes School produce worth Rs. 161 at Jambul and Rs. 68 at Alibag used for maintenance of students. All the remaining expenditure was entirely met from public funds. At Jambul the large capital expenditure in the year 1920-21 was due to wire fencing and erection of an oil engine ; the increase in 1921-22 in the cost of establishment is due to general revisions in the pay, the increases of the previous year being also drawn and included in this year. At Alibag, the only item of difference is an increase in the cost of recurring contingent charges which is due to temporary structures and repairs to field *bandhs*, etc.

Receipts actually credited into Government treasury were as follows :—

	Jambul.	Alibag.
	Rs.	Rs.
Sale proceeds of School produce	536	334
Proceeds from Mr. Pisal's Land Trust	300	....
Contributions from the District Local Boards	864	....
Total ..	1,700	334

58. *Further Developments.*—At Jambul, an engine shed was provided and arrangement for leading water over the whole area under command has been made, which will enable the cultivation of a larger area under garden crops. The arrangement for providing a supply of

pure water for drinking from a deep bore has also been completed. A building for workshop practice and the provision of a bath room, gymnasium are yet the pressing needs.

The Alibag School continued to work under the same temporary arrangements as mentioned in the last year's report.

59. *Effect of and Public Opinion about this Form of Vernacular Agricultural Education.*— The extent to which the two schools have been taken advantage of from the time they were started is indicated in the following table :—

Name of School.	1917-18	1918-19	1919-20	1920-21	1921-22
Jambul	13 (one class only being the first year.)	27	25	19	29
Alibag		11 (one class only being the first year.)	22	12	12

Owing to the very poor attendance at the Alibag Agricultural School, Government have decided to close it down after the completion of the school year under report.

The following statement details how the students that have passed out of the two schools are occupied in their post-school life :—

	Jambul School.	Alibag School.
Gone back to their own lands ..	12	4
Service connected with agriculture	3	....
Continuing their secondary education.	6	5
Service or business other than agriculture	10	4
Whereabouts untraceable	3	..
Total of students that passed successfully up to date ..	34	13

This year in order to demonstrate all the arrangements at the schools in actual working operations to the head masters of primary schools teaching fourth standard and above and prospective boys with their guardians from Kolaba and Thana districts, parties of ten selected School masters with four prospective boys and their guardians from the locality served by each school were called. But only four schools from Kolaba, and one School from Thana district responded. Every manner of teaching, of lodging and boarding arrangements and of the daily programme of life at the school was explained and demonstrated in actual operation and discussions on any points of doubts, defects and suggestions were invited.

The school masters acknowledged that they had really no idea of the most useful and practical sort of education that is imparted in the agricultural schools, that they were fully convinced of the same after seeing these demonstrations and that this would help them considerably in conveying a correct idea of the agricultural schools and inducing the guardians of boys to avail of this very useful form of education. The few guardians that came did not however voice anything.

This year's experience has not brought out any new facts over those mentioned in the report of 1919-20 about the opinion and attitude of the public towards this form of vernacular agricultural education. An attempt was made to carry on for some time vigorous propaganda accompanied by magic lantern demonstrations illustrating the matter and manner of teaching and working and care of students at the agricultural schools, with some success ; this is however a very costly method, and paying a fixed honorarium to the primary school teachers for every boy that would be contributed is suggested as a much cheaper method of propaganda.

It must necessarily be a long time before the influence of agricultural education will be widely and appropriately appreciated. A sufficiently large number of boys must pass out of the School and work in agriculture as grown up responsible men when the effects of education received by them are bound to reflect in their methods of work and thus be visible and act as an incentive to others to get their boys similarly educated. This stage must however be gone through at some time or the other. The present central nature of the agricultural schools has made them very expensive particularly on account of the free boarding that has to be provided, and the money spent on such central schools at present could probably be made to go much farther by introducing agricultural instruction in the higher standards (from the fifth onwards) of the large rural primary schools having not less than ten to fifteen students in the higher standards.

Personal.

60. The undersigned held the charge of the Division throughout the year ; he toured for 217 days in all the four districts of his jurisdiction for the purpose of inspection and direction of the work in progress and further developments.

All the posts of the division were full. Mr. D. N. Desai, Agricultural Overseer, Thana, had to proceed on long leave for reasons of ill health and Mr. B. W. Sakhalker, B.Ag., who has been entertained in his place as acting is undergoing training. With this exception there has been no change in the personnel.

All the superior staff with the exception of one have worked faithfully and hard to the best of their respective abilities and capacities, which however fall into four or five grades. Thus out of a total of 15 graduates one occupies a specially high class, one or two are first rate and the remaining are about equally divided amongst the second and third ranks.

V. G. GOKHALE,
Deputy Director of Agriculture,
Konkan Division.

APPENDIX G.

SUMMARY REPORT OF WORK DONE UNDER THE DEPUTY DIRECTOR OF AGRICULTURE, SIND, FOR THE YEAR 1921-22.

ORGANIZATION.

1. Soon after the termination of the Great War, which kept most things in abeyance, I submitted a scheme, early in 1919, for the development of the Department of Agriculture in Sind. The general consequence of the financial situation, is that the scheme has not been given effect to in any single detail.

2. Mr. Khubchand Thadani who was deputed to Texas Agricultural and Mechanical College in December 1920, for a year's higher training in Plant Breeding, with special reference to American Cotton, returned in February 1922. Mr. Thadani made good use of his time, secured the degree of M.Sc., with honours, and brought home some very high testimonials from his professors and other scientists both in America and England. He has been appointed to the post of Cotton Breeder in Sind but, owing to the absence of a botanical Department in Sind, it will probably be found necessary also to utilize Mr. Thadani's services on certain other, even more important, crops than cotton, such as rice and other cereals.

3. There is nothing else of special importance to mention under Organization except to point out that the general outline sketched in paragraph 3 of last year's report stands good, save as regards Substations which have mostly been closed down, as they proved relatively expensive especially when run departmentally—and the tendency now is to conduct field demonstrations upon the lands of selected zamindars.

4. Government have recently decided to constitute a number of Divisional Boards of which there is to be one in Sind. The object of the Boards is to co-ordinate the work of the Agricultural and Co-operative Departments where these impinge, and to associate the public in the policy of the Department and the direction of propaganda. The Sind Divisional Board is to consist of the Deputy Director of Agriculture as Chairman, the Assistant Registrar of Co-operative Societies and four non-officials—two representing Agricultural interests and two Co-operative interests.

For this purpose the Board will control certain expenditure devoted to propaganda.

SEASON.

5. The season of 1921-22 must be acknowledged as a good one. The inundation was good and lasted well, and was particularly good in the period August-September when rabi lands are flooded. There was some delay in getting water for cotton sowings in the Hyderabad tract, and the cotton area shows some shrinkage.

The Jamrao-Mithrao tract which depends upon the Eastern Nara supply channel stands in a category by itself owing to trouble at the mouth of this channel, and the Irrigation Department found it necessary to restrict cotton sowings on the Jamrao to about one half of normal, and to ration the water at the end of the kharif season between Mithrao rice and Jamrao cotton—and there was very little rabi cultivation on the Jamrao area.

There were favourable rabi rains in December, and also good kharif rains in July-August all over the south of Sind.

Frost did not do any material damage. Crop pests particularly rats in the south of Sind and crabs in Mirpur-Bathoro Taluka caused much injury—the former to both rice and wheat and the latter to rice.

There was a good deal of boll-worm on the Southern Jamrao area, but the jowar crop in the north of Sind did not suffer much from Borer.

Karachi taluka potatoes again fell a victim to disease. In the year under report " Early Blight " (Alternaria Solani) did great damage—wiping out many fields. This disease was favoured by the rain which fell in mid-December.

The cattle, especially in the South of Sind, were in very bad condition during the first half of 1921, as the absence of rain in the previous year left the country without grazing. The failure of the Jamrao Canal in the rabi of 1920-21 greatly increased the difficulty and a fodder famine prevailed until the heavy rains of July 1921 relieved the situation. Preceding this relief, the situation was very bad. Large numbers of cattle died estimated at 50 per cent. by some observers. A small census taken near Mirpurkhas revealed the following facts :—

Fate.	Plough cattle.	Milch cows.	Young stock.	Buffaloes.
Died	26	44	39	8
Survived	24	51	9	5

The people could not afford to import fodder in bulk but there were many pathetic instances of petty imports. The babul tree proved the main fodder reserve, and the people collected such things as " Jhil ", " Phurwan " and " date-palm " leaves.

In the north of Sind cattle mortality was high, but this was due chiefly to disease. The price of wheat rose to Rs. 11 at seed time and hence there was much difficulty in procuring seed for the large area sown with wheat.

Seed-cotton went up to Rs. 18½ in October and remained round about Rs. 13 for a considerable time, ultimately declining to Rs. 12 per maund.

The price of jowar fodder rose to Rs. 50 to Rs. 60 per 100 bundles (of 26 lbs.) near towns in November 1921, and in the country districts stood at Rs. 16 to 30 in the same month.

RESEARCH.

Crops—Cotton.

6. *Sind-deshi.*—The work upon the several strains of Sind-deshi cotton was continued. The strain 27 W.N. which has been selected for distribution again did very well. This cotton was sown on a 3-acre scale on the 23rd May and gave an average yield of 15¼ maunds of seed cotton per acre, which gave a ginning outturn of 39 per cent. (on the power gin) against 33·5 of ordinary deshi. Expressed in another way, this means that if a given quantity of seed-cotton of ordinary deshi were to yield 100 bales of clean cotton—then the same quantity of 27 W. N. seed-cotton would yield 116½ bales—with the further advantage of less soil exhaustion.

The above mentioned yield works out to about a bale and a quarter per acre. The percentage of stained seed-cotton in the lot was found to be 7.

It is interesting to note that this cotton was watered once after the end of September, on the 22nd October 1921, and yielded its crop as noted in the margin.

Month.	Quantity of seed-cotton in lbs.
October ..	1,451
November ..	1,642
December ..	594
January ..	136

In the season under report rain interfered with germination and prevented reliable results being obtained but the following strains also gave much promise 1YN, 6. Y. N., 45. Y. N., 18 Y. N., 7. Y. N., 3. W. N., 5 W. N., 13 W. N.,14 W. N., 26 W. N.

Observations have revealed the frequent occurrence of cleistogamic flowers, especially when the crop is grown under conditions of semi drought. It has been ascertained however that this character is not transmitted, and must therefore be ascribed to the environment.

7. *American Cotton.*—Serious attention was turned to American cotton about 1913 when a large consignment of seed was imported from the United States of America after trials on a small scale, and a visit to the States by the then Deputy Director had indicated the promise of this cotton in Sind.

The primary object in view was to obtain broad results, *i. e.*, to ascertain whether Sind is suitable for the cultivation of such cotton. It was then considered more important to clear up this broad issue than to insist upon botanical researches with a view to obtaining a fully acclimatized and proved variety, which would have caused several years delay, and would have left the general issue unsolved—" Can American Cotton be successfully grown under Zamindari conditions in Sind ?"

The variety imported on a large scale in 1913 was Triumph, as decided by Mr. Henderson, after his visit to the States. This is a large bolled variety. For the first few years this cotton did fairly well both in the districts and on the Government Seed Farm, but by 1916-17 the bolls were noted by Mr. Henderson to be definitely smaller than those of standard Triumph. This was considered to be very probably due to the Sind environment where the high temperatures might quite naturally cause a reaction of this kind. However it was decided to test other explanations, such as botanical impurity ; and hence a small consignment of 100 lbs. of Triumph was obtained in 1918-19 from the United States Department of Agriculture. It was specially stipulated that the seed should be botanically pure, and seed was secured through the kind services of Mr. David Fairchild, Agricultural Explorer, Bureau of Plant Industry, Washington—from the Mark W. Johnson Seed Coy., Atlanta.

On arrival it was found that the sample contained different types of seed as noted in the margin. Botanical work was started at once on this material and crops raised from seed of each of these types—which however did not breed true and it was concluded that these three types of seed did not necessarily prove botanical impurity. There was no obvious distinction in the plants raised from the seed types. At the same time 100 individual plants were selected in 1919-20 to raise up pure line cultures.

(*a*) Naked Seed, black.
(*b*) Fuzzy seed, green.
(*c*) Fuzzy seed, white.

The great majority of these cultures proved very susceptible to leaf-blight and ultimately all were rejected. In 1919-20, a wet year, two acres of this New Triumph sown at Mirpurkhas in good plots (C2 and C 3) completely failed owing to the virulence of this disease.

Hence it was concluded that it was unlikely that any cotton useful to Sind could be bred from this importation, and in the meantime Punjab F4 American was making phenomenal

progress in the Punjab. This cotton was tried in Sind in 1917-18 and subsequent years, with very promising results.

In the wet year of 1919-20 an area of 30 acres on the Mirpurkhas Seed Farm yielded a crop varying from 5 to 13 maunds of seed-cotton per acre, and reached a maximum of 15 maunds. But a still more satisfactory result was the early maturing character of this cotton and its relative resistance to Red Leaf-Blight. Punjab F4 in fact is slightly earlier in maturity than deshi. This cotton was also put out in the districts and met with much approval.

It appeared in fact that we had found an American cotton which possessed the Agricultural characters demanded by Sind, under its present inferior irrigation system. This asset was considered more important and valuable than the character of long staple which is not a characteristic of F4 whose staple has been placed at $\frac{6}{8}$ths to 1 inch (*vide* Indian Cotton Committee's Report Page 11). It was assumed that even a low-grade American Cotton, provided its performance in the field was good, would be an immense improvement upon Sind-deshi cotton.

Unfortunately this assumption proved unjustified when judged by the standard of money return to the cultivator. The difference in price or premium for F4 over Sind-deshi seed cotton, has been most disappointing. Previous to 1921-22 a small premium of Rs. 2 to 3 per maund was secured, but in 1921-22 the season opened with no premium at all. The principal buyer (Messrs. Ralli Bothers) in the previous year stated that the World's market was glutted with law-grade American cotton owing to the huge carry-over of 9,000,000 bales from the previous crop. This view was confirmed by the Japan Cotton Trading Coy., who had been very large buyers of Punjab-American Cotton in previous years ; they stated that their Japan mill clientele had informed them that they could meet their requirements more cheaply by buying cotton grown in the United States of America.

The issue became complicated by a bad sample of Sind American finding its way down to Bombay early in the Season—and also the reflex of the Punjab crop which proved to be a complete failure both in acre-yield and quality of fibre, had its adverse effect upon the smaller Province of Sind. In addition to this, some of the crop was badly ginned.

In these circumstances the Sind crop proved very difficult to market, and it seems that one cannot count upon more than a small premium of 10 or 12 per cent. for the seed-cotton and for this petty premium the grower is entirely dependent upon the inclination of the buyer.

The personal experience of the Department in the year under report has been good. An area of 30 acres sown with Punjab F4 yielded over 25 bales of cotton which was valued by the Cotton Contracts Board as follows :—

Sample.	Value in rupees per candy.	Remarks.
Saw ginned	460 to 470	With fine Oomra at Rs. 400.
Hand-roller ginned	395 to 410	With F. G. Broach at Rs. 460.

A comparative experiment between F4 and the best of the deshi strains, 27 W. N. was conducted on an area of 6 acres at the Seed Farm in the year under report. Two small areas of $\frac{1}{8}$ of an acre each, where both cottons were fully developed and free from the interference of kalar salts, etc.,—gave the following results :—

Name of cotton.	Yield of seed-cotton in lbs. per acre.
Punjab F4	1624
27 W. N.	1539

In the district a certain zamindar, the Honourable Mr. Bhurguri, grew F4 on an area of about 1,200 acres and obtained an average yield of 6 maunds per acre, the season not being very favourable owing to irrigation shortage.

The same Zamindar got an average of 6½ maunds from our best deshi strain, *viz.*, 27 W.N.

The ginning percentages at the seed-farm worked out to 32·3 in the case of F4 and 39 in the case of 27 W.N. It will be noted that in this respect F4 is decidedly inferior to the best deshi strain, but is not so markedly inferior to ordinary deshi, with a ginning percentage of 33·5 per cent.

Punjab F4 is no longer botanically puré, and it has been suggested that this is the real cause of the marketting difficulty. I do not share this view because botanical impurity in a low grade cotton is not fatal, unless it can be shown that a considerable element of the impurity is decisively inferior to the standard of cotton concerned.

It is now becoming increasingly recognised that environment is capable of causing as much lack of uniformity, as botanical impurity. In Sind this will always present a very difficult problem because there is an immense variation in the quality of the soil within very short distances.

My general conclusion is that the future American Cotton for Sind will have to be founded upon Punjab F4, and that the staple will have to be added through judicious hybridization with some superior variety from the United States of America. When this is done it will be necessary to have a number of grades corresponding to the varying environment, because the Province is unlikely to produce a uniform trade type, even from a pure botanical type.

Mr. Thadani who has recently returned from the United States of America has brought with him about 20 of the most promising cottons of the States and these are now being grown at Mirpurkhas.

8. *Cotton diseases, etc.*—"Wilt" (Fusarium spp) was again present on the Seed Farm, and was quite as destructive to F4, as to deshi. It is now giving cause for alarm on this Farm as the patches of crop destroyed were considerable. It seems to be favoured by impervious soils which retain too much moisture after irrigation.

Organisms like Rhizoctonia fungus were also found in the roots of wilted plants by the Second Imperial Mycologist.

Deh 21 Sinjhoro Taluka.
Deh 270 A Jamesabad Taluka.
Deh 110 Mirpurkhas Taluka.

"Wilt" disease in cotton was noted in the marginally noted villages in the year under report.

Boll-worm did a good deal of damage on the Southern Jamrao in the year under report. A count of 281 bolls made in plot VIII on the Mirpurkhas Seed Farm on the 21st October 1921 showed the damage to be 12 per cent.

Wheat.

9. The opening of a large seed farm for wheat, near Jacobabad in 1919 has provided the means for dealing adequately with this very important cereal. The Farm is now in good working order. Pusa 12 is the variety upon which principal attention is being concentrated as it has proved very popular in many parts of Sind, but it is intended to produce seed of superior strains of the principal Sind wheats, especially Toree and Phundani, as there will be a demand for such seed.

We have now made considerable progress with the production of cultures raised from single plants in all the Sind varieties and these are being tested and compared.

As regards Pusa 12, this is an awnless wheat. It produces large earheads, and its flour is of very high quality. In this respect the grain meets with the full approval, both of the Indian consumer and the foreign exporter. This wheat is a very early variety; and it is very important not to sow it too early. At Jacobabad earheads appear 80 days after sowing, and hence it is not safe to sow it before the last week of November, lest it gets caught by frost in early February. This wheat is a good yielder—20 maunds per acre having been secured in several parts of Sind, where the conditions were favourable. This wheat can be grown either as bosi (*i.e.*, unirrigated after sowing) or as an irrigated variety. In both cases it responds well to good treatment and is to be strongly recommended for land in good condition. This wheat has now had a good trial over all the principal wheat areas in Sind, and the highest yield so far reported has been 29 maunds per acre at Buxapur in the Upper Sind Frontier District. This however was a small area.

Rice.

10. The new low-level irrigation channel at Larkana has given this Farm the necessary irrigation facilities to enable work on rice to be properly carried out. A commencement has been made with the raising of a large number of pure line cultures in the principal ten varieties of North Sind.

There is considerable diversity of work being conducted on this crop at Larkana which will be referred to under appropriate headings.

Jowar.

11. An attempt has been made at Larkana to classify the jowar varieties of Sind—many of which are very fine. Perhaps the most remarkable crops of jowar in India are to be seen in Sind, as the height reached is most imposing. The varieties merge into one another and a clean cut classification seems very difficult.

A tentative method of classification has been attempted, somewhat on the lines adopted in Bulletin No. 92 of the Bombay Department of Agriculture.

Colour (of grain).
Density of Earhead.
Length of Rachis.
Width of Earhead.
Colour-shade of the glume.
Size and shape of grain.

The simplest plan seems to be to adopt the "Tabular Key" system with reference to certain conspicuous characters. The characters selected for this purpose are noted in the margin.

By this system practically every variety—and there are some 60—can be traced down to its place in the "Key".

Berseem.

12. The investigation of special importance on this crop is the home-production of seed. Work in this connection is in progress at Sukkur and Larkana, but the seasons' results are not available yet. It seems probable that it will prove much easier to handle the operations in the north of Sind than in the south where the strong winds not only shrivel the crop but blow the cut portions out of the field.

The seed comes to maturity late in May or in June. Recently there has been much trouble with imported seed owing to the latter containing dodder. In the season under report all imported seed was most carefully sieved, and the dodder trouble was greatly reduced.

IRRIGATION.

13. In the Sukkur Barrage and Triple Canal Scheme the assumed "field duty" for rice is taken at 50. This is a much higher duty than has ever before been considered possible but a comparison between current conditions and post-barrage conditions is difficult, and higher duties should certainly be obtainable under the latter.

Investigations upon Rice "duties" were carried out at Larkana in the year under report. Two acres of land divided into 4 plots of ½ an acre each were set aside for this purpose as shown in the margin.

Series	Plot.	Area in acres.	Variety.
A	III 2	½	Sugdasi
A	IV 1	½	Sugdasi.
B	III 2	½	Kangani.
B	IV 1	½	Kangani.

It was intended to apportion the water in such a way as to give a "field" duty of 50 to plots A III. 2 and B III. 2 and 40 to plots A IV. 1 and B IV. 1 but it soon became apparent that the quantity of water entering the plots was insufficient to ensure a normal crop. Hence it was decided to give all the plots as much water as the judgment of the officer deemed necessary for the proper development of the crop.

Plot B III. 2 had to be rejected as it was found to receive seepage water from an adjoining rice field and hence the results of the other three plots only are dealt with below.

Two varieties of rice were experimented upon namely Sugdasi or late variety and Kangani or medium early variety. The former was transplated on the 7th July and irrigated until the 30th September, *i.e.*, for 86 days, and the later was transplanted on the 20th July and irrigated till the 17th September, *i.e.*, for 60 days.

The site of this experiment consisted of rice land which had been thoroughly ploughed in the *rabi* season and hence the initial soaking water was considerable amounting to 10½ inches in the case of A Series and 12 inches in the case of Series B (Plot IV. 1). This was applied in the 2 days preceding transplantation, and as this would have an unfair effect upon the duty a period of 10 days has been added, in the case of Series A, to the 86 days in which the crop was irrigated, as a corrective, and 12 days to the 60 days in the case of Series B giving values of

96 and 72

to the symbol n in the formula

$$d = \frac{2n}{\Delta}$$

where d = duty in acres

n = period of irrigation in days

Δ = delta in feet.

The gauge used was the cippoletti weir of one foot in width and care was taken to see that there was no current in the water passing over the crest.

Readings were taken every 10 minutes commencing 5 minutes after the water commenced to overflow the crest so as to allow for any initial disturbances caused by opening the weir. These readings were then averaged and the discharge in cusecs ascertained from the Tables.

As the area of each plot was ½ an acre a simple calculation gave the quantity of water applied in inches.

The total deltas thus arrived at were as follows :—

Plot.	Delta in inches.		
	Initial soaking water.	Irrigation given to the crop.	Total.
A. III 2	10·539	51·369	61·908
A. IV 1	10·448	46·029	56·477
B. IV 1	11·904	30·153	42·057

Hence the field duties work out as follows as shown below :—

Plot A. III. 2 $d = \frac{2n}{\Delta} = \frac{2\times96}{62/12} = \frac{2\times96\times12}{62} = 37\frac{1}{3}$

Plot A. IV. 1 $d = \frac{2n}{\Delta} = \frac{2\times96}{56/12} = \frac{2\times96\times12}{56} = 41$

Plot B. IV. 1 $d = \frac{2n}{\Delta} = \frac{2\times72}{42/12} = \frac{2\times72\times12}{42} = 41$

In the early stages the crop especially in A. III. 2 received a check owing to insufficient water hence it seems fair to conclude that the quantity of water used was under rather than over the mark to ensure a full crop.

The outturns which are tabulated below are fair but by no means bumper :—

Plot.	Yield per acre.	
	Grain in lbs.	Straw in bundles.
A. III. 2	1,532	34
A. IV. 1	1,492	56
B. IV. 1	1,776	34

The general conclusion seems to be that the " duty " for rice at Larkana should be 40, but a careful study of the register—in which the quantities of water applied are recorded—shows that the " duty " varies greatly with the stage of the crop. At the beginning it is very low—about 24. But subsequently it gradually rises until the duty becomes about 96 at the close of the season.

Now this is a very significant fact because it means that if the planting period could be spread out over three months then the area of rice could be increased without increasing the irrigation supply.

The following tentative requirements of Sugdasi rice have been drawn up with reference to the actual records of the season under report-the crop being transplanted on the 7th July 1921 :—

First	25 days (including 10 days soaking) at	1″	per day 25″
Second	20 days	¾″	,, 15″
Third	30 days	½″	,, 15″
Fourth	20 days	¼″	,, 5″
Total	95 days	Total 60 inches.	

Now if we suppose that there is a steady supply of one cusec of water available from the 25th April to 8th October it might be possible according to these requirements to plant and mature some 50 acres of rice as shown in the following statement :—

Area in acres.	Date of commencing flooding or soaking the land.	Date of transplantation.
24 ..	25th April ..	5th May.
6 ..	20th May ..	1st June.
6 ..	15th June ..	25th June.
10½ ..	10th July ..	20th July.
3½ ..	5th August ..	15th August.

But the feasibility of this plan depends upon whether a small supply of ¼ inch per day after the 10th July to rice transplanted on the 5th May, is practicable. It must be acknowledged that 66-day-old rice transplanted early in May will be less advanced than rice of the same age transplanted in early July. This is a point on which further investigation is necessary.

14. A very important practical problem in connection with the irrigation of rice came prominently to notice in the year under report. The Eastern Nara channel supplies two irrigation areas, namely the Jamrao and the Eastern Nara areas, and the demands of these areas came into sharp conflict, owing to the season being a late one, and the rice in the Eastern Nara Division being sown late in consequence. The Jamrao grows a large area of cotton and also a considerable area of wheat hence in this area the demand for water in mid-September to mid-November runs high owing to the overlap of the kharif and rabi seasons. During this period practically the whole of the " soaking " water for wheat has to be applied, and the cotton crop requires liberal irrigation, not only because the month of October is very hot, but because the bulk of the crop matures during October and November.

On the other hand the Eastern Nara area is mainly a rice tract, with some 100,000 acres of paddy.

The variety in common cultivation is Ratria, and the people maintain that this variety must be irrigated till the end of October, and it is also asserted that this variety requires a considerable depth of water on the field at the time of maturity, otherwise it does not ripen properly.

It appears that one reason why a full supply during October is demanded, is because the people are dilatory at the beginning of the season and allow sowings to drag on through July. The Executive Engineer, Eastern Nara, states that in a normal season much of the crop is sown in the first half of July—assumed at one-third of the total area in some of the correspondence seen by me. In this connection it is interesting to observe that in the north of Sind the demand for water by rice gradually declines from the early part of the season and that during the last three weeks about $\frac{1}{4}$ of an inch per day suffices. This corresponds to a duty of 96. Now it is stated that in an average season there is at least 5,000 cusecs available in the Eastern Nara supply channel up to mid-October.

The rice area in the Eastern Nara Division is 100,000 acres, and hence when half this supply is made available, it follows that the Canal duty is 40, and presumably the field duty 50, which means approximately $\frac{1}{2}$ an inch of water per day. Even when the rice supply falls to 2,000 cusecs (the amount suggested by the Jamrao Executive Engineer) the quantity of water put on the rice fields each day amounts to $\frac{2}{5}$ths of an inch which is liberal in comparison with what is found adequate at the close of the season in North Sind.

There is however a further important complication. There is a tendency to extend cotton cultivation in the Eastern Nara Division and the area under this crop is becoming formidable and may reach 50,000 acres, in which case another 500 cusecs would be required allowing for a field duty of 125 on the Eastern Nara Area at this time of year.

15. To summarize, the issue at stake is this :

The Irrigation Department have fixed the distribution of the available water as follows :—

Season.	Jamrao Area.	Eastern Nara Area.
Kharif	5/13	8/13
Rabi	$\frac{2}{3}$	$\frac{1}{3}$

and the difficulty arises over the decision when the kharif season should be considered to end for the purposes of this allotment of water.

The Jamrao overlap sets in about mid-September and the demand rises to its maximum by the end of that month, which continues till the middle or end of November. It would therefore suit the Jamrao area gradually to effect the change from the kharif to the rabi distribution during the period mid-September-mid-October.

The Eastern Nara however demands that the kharif supply should remain intact till the end of October.

Pending further observations on the cultivation of rice in the Eastern Nara Division, the Irrigation Department has decided upon a compromise.

The kharif distribution is to remain intact till the end of September, and the transition from kharif to rabi distribution is to be gradually effected during the first half of October—so that the rabi distribution comes into force in mid-October.

16. It seems to me that there is a strong case for taking such steps as may be practicable to expedite the close of the kharif season in the Eastern Nara Division, so far as rice is concerned. This might be achieved by indirect methods, by diminishing the water-supply at the close of the season so that zamindars would come to realize that if they want to mature their rice they must be more expeditious in getting it sown. This would be facilitated by increasing the sowing water early in the season. Nature has imposed a similar incentive upon the Hyderabad cotton growers who fully realize that they must sow their cotton early or not at all, as the irrigation facilities are such, that late sown cotton has not much chance of proving a business proposition.

Another line of procedure is to change the variety of rice, and some zamindars have been turning their attention to Sathria, an early variety, but there is little reason for supposing that Ratria will fall out of favour if a full water supply is provided till the end of October. There is always a prejudice in favour of an old established and popular variety, especially if it is a superior one, as is Ratria.

A careful series of observations will be made in the season 1922-23 to clear up the exact irrigation period of Ratria, which local opinion makes out to be 5 months. If this can be disproved the problem will be greatly simplified.

17. The irrigation requirements of cotton were further observed in the year under report. On the Mirpurkhas Seed Farm Series XI was drilled, half with Punjab F4 and half with deshi (27 W. N. strain)—on the 23rd May. Altogether 5 irrigations were given—the first after the lapse of about 40 days from sowing and the last on 22nd October. About 80 per cent. of the crop was harvested in October and November of which over half was in the latter month. The advantage and need of irrigating Jamrao cotton until the end of October is therefore obvious.

Implements and Machinery.

18. This section was dealt with rather fully in last year's report.

The important development in the current year has been the attempt to meet the demand for iron implements in India. Messrs. Kirloskar Brothers of Kirloskarvadi (Deccan) have greatly expanded their business and are now anxious to expand the territory for which they cater. They have recently been giving special attention to the imported iron ploughs which have met with favour in Sind, and they estimate that they could manufacture equally good ploughs for about half the cost of imported ones, *e.g.* They compute that a plough like the Rajah could be made for Rs. 35 (packing and freight extra) against Rs. 59 for the imported article, and that a plough like the Monsoon could be made for Rs. 20, which costs Rs. 42 to import. Imported shares for these ploughs run to Rs. 4 and over, but Messrs. Kirloskar think they could turn out equally good shares for Rs. 1-8-0, if made in one piece without the separate point.

Another promising iron plough for Sind is " The Orient ". It has a long pole and single handle like the deshi plough, and local ploughmen take to it on this account—but the cost of the imported article is Rs. 32.

The Egyptian plough continues to be the popular improved plough with the Sind ploughman. Steps are being taken to teach local mistries how to make and repair this plough.

It is now possible to resume the importation of steel shares for this plough. These work out at approximately Rs. 2-8-0 each.

Howards Crosskill or Cambridge Roller is proving invaluable in connection with the tillage operations at Mirpurkhas Seed Farm. A light pattern costs about Rs. 300, and is thus too expensive for the average man to buy. This is one of the first implements which should be placed in an implement depôt for hire purposes.

Apart from the primary function of crushing clods, this machine is a first class packer and by its use the moisture in the sub-soil can be drawn up, which facilitates good germination and more shallow sowing for a crop like cotton.

19. The problem of finding a good drill especially for cotton, is still a pressing one. It must combine simplicity with efficiency. There are good cotton drills on the American Market, but they appear to be too elaborate in construction to find an opening in Sind, and they are also expensive. Hitherto the most satisfactory method of drilling cotton in Sind has been to attach a seed-bowl and tube to an ordinary Marwar plough. This Marwari drill does very well and is simple and cheap, but occasionally there is trouble, *e.g.*, when it is necessary to drill relatively deep in order to reach the moisture it is apt to allow too much loose soil to fall above the seed, thus interfering with even germination. One method for preventing this has been to attach a ridging board to the plough.

It is proposed to give a trial for cotton to Howard's Dingo Maize planter, which is a simple machine, weighing about 2 maunds.

In the case of wheat very good results were obtained with the Hoosier drill at Jacobabad, but in order to prevent obstruction caused by loose soil when drilling deep it was found expedient to remove alternate discs and to sow the wheat in lines one foot apart. This is about the average width at which the deshi drill sows wheat. This drill was hauled by the Cletrac tractor, but was too light to absorb the full power of the tractor. This tractor has also been utilized for ploughing and clod-crushing, but not on a sufficient scale to yield economic results.

Tillage and Cultural Problems.

20. In North Sind it is common to take a second crop after rice. This is usually a pulse or an oilseed, and it is grown as dubari (*i.e.*, unwatered). This practice is possible where the soil retains ample moisture but there are many lands which, either because of their high situation or bad texture, are incapable of sustaining a dubari crop. Such lands offer great scope for the use of the iron plough which should be worked once or twice during the rabi season. This practice has been adopted on part of the Larkana Farm, and the advantages claimed for it are—

(1) it opens the soil and permits of good æration.

(2) it incorporates the rice stubbles in the soil, thus improving the texture and adding to the fertility of the latter.

(3) it destroys troublesome weeds like " kăl " (*cyperus rotundus*).

(4) it leaves the land ready for immediate transplantation in the following season, without the necessity for any further tillage operation—thus relieving the hari of much troublesome plough work, in watersoaked soil, at a time when he is very

busy, and hence he is able to get the crop transplanted rapidly, and even to deal with a larger area.

(5) the young seedlings transplanted in soil thus prepared make an excellent start, much surpassing those planted in fields which are ploughed up in wet condition at the beginning of the season.

Early transplantation.—Experiments have been conducted for some years, to investigate the advantages of transplanting rice relatively early. In the year under report on Larkana Farm two demonstration plots were transplanted on the 22nd June. The Sugdasi variety which flowered about mid-September was ready for harvest on the 29th October and yielded over one Kharar per acre ; while the Kangani variety flowered by the 21st August and was ready for harvest by the 29th September. This crop sustained some damage from a storm at the end of September, but yielded close on one Kharar per acre. A Kharar is 1,560 lbs.

It is sometimes asserted that earlier transplantation does not result in earlier maturity, but this is only partially true. For example in the year under report at Larkana the Sugdasi variety was transplanted on two plots with an interval of a fortnight, and the crop on the earlier planted plot matured one week earlier than the crop on the other plot. Again a difference of four weeks in the transplantation of Kangani rice resulted in a difference of two weeks in the dates of maturity.

Seed-rate Economy.—The experiments conducted on rice for some years at Larkana and Sukkur show that a full crop can be procured with a seed-rate of 10 to 12 seers per acre of transplanted rice—to be sown in a seed bed of 1½ gunthas, against the customary rate of 32 to 52 seers per acre.

Rice.—berseem rotation—Good results have been obtained at Sukkur by adopting this rotation. A piece of land measuring about five acres and extending over the whole of F Series on the Larkana Farm has now been assigned to this rotation. It has great significance with reference to post-barrage days when there will be a good supply of rabi water in the rice area, which can not be made good use of by the common crops like wheat which do not well rotate with rice. On the other hand a dairy industry might be built up on berseem which would react enormously on the pitch of the rice yield.

Soil Fertility.

21. At Mirpurkhas the importance of conserving the organic matter of the soil is being well demonstrated by the reverse process. Until a few years ago berseem could be grown with tolerable regularity but recently the rabi supply has been so deficient that little of this crop could be grown, and its absence is clearly marked upon the texture of the soil. Many plots which gave little trouble a few years ago, now demand much labour in the preparation of a seed bed and even with this, the desired tilth cannot be secured. In these circumstances attention is being turned to growing Sann in the kharif, which however is not so satisfactory, as all kharif land in this tract is wanted for cotton and bajri.

There is a good deal of evidence that soil fertility is not being maintained on the Jamrao area. Experienced officials affirm that the pitch of yield is much lower than what it was 12 or 15 years ago. On all sides there is now a tendency to manure the land or at least to apply silt, before taking a crop. A series of pot-experiments have recently been initiated for the purpose of throwing light on the exact cause of this phenomenon. Of course it is obvious that cotton and cereal crops cannot be cultivated over a long period of time without soil depletion. Apparently what is primarily required is some easily assimilable form of nitrogen which in practice is not forthcoming in the ordinary artificial fertilisers—judging by the negative results which have accrued from the trial of these fertilizers.

Fruit.

22. The Horticulturist to the Government of Bombay has recently paid a visit to Sind and is much impressed with the possibilities of the Province for fruit-culture. There are about half a dozen fruits of first class commercial importance for which the Province is very suitable. The grape does well everywhere especiallly at Shikarpur where it should be easy to introduce the raisin industry.

The Riverain area at Rohri and neighbourhood is ideal for the date as the fruit ripens on the tree, unlike most parts of the world. It is very difficult however to secure fruit-stock in large quantity, and hence imports on a big scale seem very desirable. The Hyderabad area offers special scope for developing the fig fruit industry ; while there is a huge field for the citrus or orange family throughout Middle Sind. We now have a good collection of noted varieties at Mirpurkhas including the Navel Orange, the March Pomelo and the Eureka lemon.

During the year under report offshoots of some of the best varieties of Egyptian and Mesopotamian dates were secured and planted at Mirpurkhas.

There seems to be ample justification in Sind for setting up the necessary special organisation essential to insure successful work on fruit.

Live Stock.

23. Apart from the Willingdon Farm which is under the management of the Veterinary Department and is devoted to the Karachi Milch breed, no cattle breeding operations have so far been undertaken in Sind. The Department however possesses a small herd of Delhi buffaloes at Sukkur. In this herd there are some excellent milkers and their youngstock seem to be well worth rearing, especially the bulls, for distribution in the Province.

The best of these she-buffaloes, Makhan by name, has the following record :—

Maximum milk yield	per day ..	34	lbs.
,,	per month ..	940	,,
,,	per lactation period of 300 days ..	6,711	,,

Miscellaneous.

24. Boring has been carried on on a small scale with one machine. At Larkana Farm water has been tapped at 42 feet and again at a lower level—but not in large quantity. The North-Western Railway have sunk a very successful bore at Jacobabad and tapped an excellent supply of water at a depth of 133 feet below ground level. It seems probable that good results would be obtained with boring in the North Sind on the right bank of the Indus, if the work could be properly controlled by a qualified Agricultural Engineer.

Potato storage operations are being conducted on a small scale at Landhi—following as far as possible the principles laid down in Bulletin No. 102 of the Bombay Department of Agriculture. The difficulties however encountered at Landhi are much greater than those at Poona because storage at Landhi has to be carried, not only through the hot weather months, but also through the Monsoon months. The Landhi climate is hot and humid and very favourable to fungoid and bacterial growth.

PROPAGANDA.

Materials.

25. The chief materials of propaganda in Sind are seeds and implements. Improved methods of cultivation, of threshing the crop and of combating crop-pests are also important.

The popularization of gram on the Jamrao-Mithrao area where it is not ordinarily grown is also meeting with success.

Distribution of seed has hitherto been on a comparatively small scale, pending the evolution or importation of improved strains or varieties.

In 27 W. N. we have a first class strain of deshi cotton and are now in a position to issue about 300 Bengal maunds of this cotton. It is being supplied partly to selected seed growers for multiplication and partly to Co-operative Unions which, it is hoped, will also act as multipliers, at least for the members of the Unions. The advantages of this variety of cotton are fully dealt with in paragraphs 7 and 8 above.

The distribution of Punjab F4 amounted to just under 2 lakhs of lbs. supplied to 200 zamindars. This could not all be sown owing to irrigation difficulties, but the area amounted to 3,078 acres, all of which, with the exception of less than 100 acres, were sown on the Jamrao-Mithrao Canal area.

In Pusa 12 wheat we have been fortunate in importing a first class wheat, well suited to a large part of Sind. This wheat is being multiplied in the first instance on the Government Wheat Farm at Jacobabad and secondly by a number of selected growers. About 1,500 maunds of this variety will be available for departmental distribution in the coming rabi season, apart from considerable quantities privately handled.

The policy of the Department should be to get a lakh of acres of each of these seeds, 27 W. N. cotton and Pusa 12 wheat, sown in Sind as early as possible. The success of this scheme however will depend very largely upon the degree of success met with in organizing Seed Unions, and there is great scope for the combined efforts of the Agricultural and Co-operative Departments on these lines.

Punjab 11 is a very good wheat for the Jamrao area and it will be pushed in this tract.

We shall soon have a fair number of pure line strains of the best Sind wheats available for distribution.

As most of the wheat in Sind is mixed—these should prove very valuable.

Name of Variety.	Quantity indented in lbs.
Pusa 12	58,480
Punjab 11	82,720
Phundani	1,000
Kahno	230

In the three northern districts the marginally noted wheat indents were received in the year under report, but only a fraction could be dealt with. Similarly in the South, indents for 1,926 maunds of Punjab 11 and 537 maunds of Pusa 12 were received.

Similar work is in progress with rice and jowar, but with these we have not reached the stage of distribution yet.

In fruit we are able to issue a large quantity of orange stock also vine stock ; and on a small scale grafted mangoes, improved guavas and stock of a few other fruits.

In implements the most popular is the Egyptian Plough, and steps are being taken to train local mistries in the making and repairing of these ploughs, as this is the condition precedent to the widespread introduction of this plough throughout Sind. In the Mirpurkhas Taluka where the local mistries have learnt now to make this plough—there is practically nothing else in use. The steel share for this plough is also available in large numbers.

26. Demonstrations in the sowing of cotton in lines were continued in the year under report.

The area operated upon was upwards of 300 acres in 21 villages as noted in the margin. Further experience of the difficulties encountered in this branch of work, was obtained. This method of sowing cannot compete with the broadcast method, so far as mere rapidity of sowing is concerned. By the latter method the seed is thrown on the moist surface of the field and buried by one or two ploughings. In the season under report owing to the late arrival of water in the canals, the necessity for hurried sowing became pronounced, and hence some zamindars sowed broadcast although they would like to have sown by the line method. Again the line method demands a field which is fairly uniformly levelled. Where, on the contrary, there are an immense number of reticulations made up of small bunds running in every direction and demarcating small areas, each of a different elevation—then the line method is hardly practicable, because inter-cultivation would result in breaking the bunds. Moreover in some parts where the holdings are small the people insist on sowing fodder crops or encouraging grass to grow in their cotton fields, as the only source of fodder. Here again there is not much scope for inter-cultivation.

Name of Taluka.	Number of Villages.
Mirpurkhas.. ..	11
Pithoro	3
Jamesabad ..	3
Hyderabad ..	3
Nawabshah ..	1

For the present, therefore, the line method offers greatest promise on the Jamrao and Mithrao Canals, and it is likely to be more successful on the lighter than on the heavier classes of soil as the latter are more difficult to bring into a fit condition for the efficient working of the drill.

27. As regards threshing cereal crops the norag machine for wheat and the stone roller for jowar, are a great improvement on the treading system.

28. The principal crop-pests complained of in the year under report were rats and crabs. Assistance against rats was given on a fairly extensive scale on the Jamrao area and in Karachi District. The poison bait in which Strychnine sulphate is employed—has proved the most successful combative measure against this pest. On the Southern Jamrao the District Agricultural Overseer assisted 92 zamindars in this way and received their appreciative acknowledgments. The crab is still under investigation.

ORGANIZATION.

29. During the year Government have issued instructions for the carrying out of an intensive scheme of Agricultural propaganda in certain selected areas. In most cases the unit of the area has been fixed as the taluka. Two areas for this scheme have been chosen in Sind, namely, Sinjhoro Taluka of Nawabshah District and Hathri Circle of Hyderabad Taluka. In both of these centres the Co-operative movement is well established, and conditions are also favourable to the introduction of Agricultural Implements. The principal features of the scheme are that a local committee shall be formed to be called the " Working Committee," and all propaganda will be conducted in the name of this committee, rather than in the name of any Government Department. It has also been laid down that this committee must contribute to the cost of the propaganda, but that condition will perhaps not be enforced in the case of Sind.

The general intention was that the committee should raise Rs. 1,000 and Government should contribute another Rs. 1,000 for the year's work. In Sind it is difficult to get men of the necessary initiative to run a committee of this sort, but the officers of the two Departments will advise and lead them as far as possible. A programme of improvements has been drawn up, and this will be put before the committee for adoption in whole or in part, when Government finally approves the scheme.

It is also contemplated to select the Sukkur Taluka as a suitable area to which to apply this scheme. The Co-operative movement is still very young in this area but the agricultural conditions are very favourable. The land is mostly in the hands of petty khatedars ; there are over 2,000 wells and more are being made. There is high class garden cultivation and heavy crops of wheat. Sugarcane is grown but the cane-mills are very crude and the people have readily responded to a demonstration of the Hathi mill.

30. It has long been recognized that the Province was too big for one Divisional Superintendent. Some years ago I recommended dividing the Province into four, with a Divisional Superintendent in charge of the district work, in each division. Government were obliged in the year under report not to proceed with the creation of a second post of Divisional Superintendent, owing to financial stringency. In these circumstances a senior graduate has been placed in charge of the three Northern Districts, under the direct control of the Deputy Director, and

proposals have also been made to place another senior graduate in charge of the Rohri-Hyderabad tract. This will give the Divisional Superintendent the opportunity of concentrating on the perennial canals, namely the Jamrao-Mithrao Area where there is more than enough work fully to occupy him. These arrangements should enable propaganda to be pushed on in Middle and North Sind which have received much too little attention in the past.

SHOWS AND DEMONSTRATIONS.

31. There was a successful Agricultural and Cattle Show held at Mehar in Larkana District in December 1921 and the Department also took advantage of Ghotki Horse Show in Sukkur District in January 1922. In the North of Sind two Demonstration parties consisting of expert coolies and trained cattle and a number of impoved implements, toured throughout the rabi season. Halts of about a week were made at each village visited, and a limited area of land was dealt with at each place. First of all work was concentrated on wheat land, and later on, attention was turned to Rice land. Altogether 27 villages were visited as noted in the margin. As a result of this scheme large numbers of the rural population saw the practical working of the improved ploughs like the Rajah, for the first time under their own village conditions. Although a fair number of ploughs were sold, the chief advantage arising out of such demonstrations, is to bring the existence of improved implements to the notice of the rural population who will no doubt weigh up the advantages of such implements after due consideration.

District.	Number of villages.
Upper Sind Frontier	13
Sukkur	8
Larkana	16

Similar demonstrations were conducted in the South of Sind as noted below :—

Name of taluka.	No. of villages.	No. of demonstrations.
Mirpurkhas ..	7 ..	8
Sinjhoro ..	3 ..	13
Digri ..	1 ..	1
Pithoro ..	9 ..	25
Hyderabad ..	8 ..	18
Sakrand ..	2 ..	27
Kandiaro ..	1 ..	1

LITERATURE.

32. The following leaflets have either been revised or prepared in the year under report :—

Revised.—

Leaflet No.	Title.
1	Egyptain Plough.
4	Improved water lifts for low lifts.
11	North-West locust.
13	Light Iron Ploughs.
18	Economy in rice seed rate.

Prepared.—

19	Mahlo disease in Mangoes.
20	Improved wheats.
21	Advantages of ploughing rice-lands in the Rabi Season with iron ploughs.
22	The advantages of early rice transplantation and suggestions how to achieve this.
23	A simple machine for treashing jowar.
24	Hand-Baling Press.
25	Hand Archimedian Screw.

T. F. MAIN,
Deputy Director of Agriculture, Sind.

Karachi, 21st June 1922.

APPENDIX H.

WORK DONE UNDER THE PROFESSOR OF AGRICULTURE, 1921-22, JUNE 31ST.

THE STAFF.

Professor J. B. Knight held charge of the office of the Professor of Agriculture upto 16th May 1922 when I assumed the charge.

Professor Knight had charge of the agricultural area connected with Agricultural Branch at the College, the College Dairy and the Manjri Sugarcane Station but since his departure on leave the Manjri Sugarcane Station has been transferred to the Deputy Director of Agriculture, S. C. D., Poona, and the report of the work on that station will be given by that Officer.

Mr. G. P. Jambhekar, B.Ag., a Demonstrator in Agriculture, was transferred to Dhulia in middle of April as District Agricultural Overseer and in his place Mr. B. P. Deshpande, B.Ag., who stood first in his class with first class honours was appointed in June. This way this branch trains up men for the district work.

Mr. K. S. Kulkarni, B.Ag., the Lecturer in Agriculture, was deputed to Kagal State for two and a half months during the summer vacation to advise the State on some land development works.

The agricultural area at the College is administered by the teaching staff. The call of teaching on the staff is rather heavy besides the farm administration work, the visitors and general demonstration work keep the staff engaged from morning to evening. There is no time left for research work.

The area attached to Agricultural Branch is wholly utilised for giving practice to the college students in the local and improved technics of agriculture. Increase in the number of students and the changes in courses adopted at the college require much bigger area than we have to enable us to give efficient training desired, even in the technics of agriculture, without attempting to do anything about the commercial side of it. I believe we ought to have a small commercial farm run entirely independent of the teaching to serve as demonstration on business side of *farming* to the students.

No experimental work was possible for want of available time and area for the staff and therefore there is nothing to report on that.

DISTRIBUTION WORK.

1. *Seeds.*—The work of distribution of seeds of various kinds is still increasing in volume.

2. Implements stored by different firms were being sold as usual.

3. Workshop did the repair work for the farms under the Professor of Agriculture and also met the demands for some newly devised implements. The morning time of the workshop was utilised for teaching carpentry and smithy to the students.

THE COLLEGE DAIRY.

The College Dairy was managed by the Dairy Staff. During the year two of the trained assistants, Messrs. S.M. Patel and H. Ezekiel, were deputed to Palghar Dairy in November 1921 and two raw graduates, Messrs. M. D. Wad and N. B. Patwardhan, were put in their places. At the same time the College Dairy was being reorganised on commercial line and the scheme was submitted by me to the Government and was duly approved and the Dairy is working up to the scheme since 1st of April beginning of the new financial year. But I find from experience that the Dairy management is greatly handicapped for want of a whole-time Manager and specially because the trained assistants have been taken away in the interest of public service and raw men are put in. As long as the Dairy was not on commercial lines this mattered very little but we cannot run such a business concern without some loss with raw men.

Teaching was carried on as before and as I was entrusted with some Dairy teaching as an Associate Professor of Dairying it relieved the Professor of Agriculture from his double duties as Professor and Principal.

HERD.

The strength of the herd on 1st of April 1922 was as under :—

Animals.	Milch.	Bulls.	Heifers.	Bull-calves.
Cows ..	30	5	30	24
Buffaloes ..	56	3	48	2

Some of the scrub animals and non-dairy animals were disposed off during the year and the new Dairy starts with the above strength on commercial line. This is the first time we have nineteen home-bred cow heifers and seven buffalo heifers in milk.

The total milk produced during the year was 199,212 lbs. which is about 32 per cent. more than that of last year. The yield of some of the best milkers during the year was as under :—

—	No. of calf.	Yield in lbs.	Remarks.
Cows—			
Aurelia	2nd calf ..	4,918	} All home bred.
Barbara	1 calf ..	4,134	
Amie	1st calf ..	4,063	Not dry yet.
Buffaloes—			
Luise	2nd calf ..	5,035	Not dry yet. Home bred.
Sexta	4th calf ..	4,359	Purchased
Chenab	2nd calf ..	3,441	Home bred.

The herd consists of now mostly Sindhi cows and Surati buffaloes.

The breeding of certain strains is continued and we find Zankar strain giving good results as will be seen from below :—

Grand dam. Zankar.	Dam. Changuni.	Chrissie	Cow. and her sister Amie.
3,117	3,741	3,919	4,063

These records are without the calves which were hand-fed entirely.

Surati buffalo strain of Sajani is also important, her yield over 14 years has been 3,410 lbs. per year and we have now the buffalo bull from this strain whom we are using to grade other animals. There is every reason to expect higher average of the future herd as we get more of our own bred animals coming into milk and this will put the concern on better paying basis.

FODDER PRODUCTION.

Thirty-one acres of the dairy site was under three crops of maize, few acres being under four crops. The average annual yield was 26,000 lbs. per acre.

The cost of production comes to 12 annas per 100 lbs. of green maize.

Guinea grass under shade and other was 5 acres, the yield per acre being 26,451 lbs. Cost per 100 lbs. being Re. 0-4-4.

This land requires to be better cropped and manured to get the best results and steps will be taken in that direction, as soon as we can have enough fodder in stock to change the cropping scheme.

B. S. PATEL,
Acting Professor of Agriculture.

APPENDIX I.

REPORT OF THE WORK OF THE AGRICULTURAL CHEMIST FROM THE 1ST OF JULY 1921 TO THE 30TH JUNE 1922.

During the twelve months under report I was in charge of the office and Laboratory of the Agricultural Chemist to the Government of Bombay, Poona.

2. The work under me may conveniently be divided into five sections for report. They are (1) Analytical work, (2) Investigation work, (3) Teaching at the Agricultural College, (4) General supervision of the manure Laboratory attached to the Union Agency and (5) Water-finder work.

ANALYTICAL WORK.

3. The number of samples received during the period under report is given below :—

Soils	260
Waters	388
Manures	188
Feeding stuffs	119
Fruits	31
Seeds and seedlings, plants etc.	44
Vegetables	8
Oils	8
Gul	11
Milk and ghee	19
Miscellaneous	66
	1,142

4. As usual samples were received from the public, both from actual cultivators and from those connectioned with Agricultural Industries. The following table will show the number of samples received from the public as compared with the samples received from Government Farms and other Departments :—

Samples received during the period of twelve months.

	Private.	Government.
Soils	57	203
Waters	20	368
Manures	37	151
Feeding stuffs	33	86
Fruits	....	31
Seeds, seedlings, etc.	....	44
Vegetables	....	8
Oils	4	4
Gul	....	11
Milk and ghee	2	17
Miscellaneous	31	35
	184	958

5. The nature of routine work was nearly of the same character as in previous years but there were some samples which deserve notice and are mentioned below as they will be found to be of interest to the public.

6. One peculiar sample of soil was sent by the Deputy Director of Agriculture for Konkan. It was from the Vengurla Taluka of the Ratnagiri District. This soil is said to be troubled by what is called "Morik" and a considerable loss is caused to the rice yield on account of it. The substance Morik contains soluble matter to the extent of 30 per cent. consisting of sulphate of aluminium, iron, lime, and magnesium. The insoluble matter contains a small quantity of free sulphur. If the '*Morik*' trouble is prevalent in any large tract, it is worth while investigating the problem.

7. Small, rounded, brown coloured hard nodules were found by the Soil Physicist in the *manat soil* when he went to examine these soils at Alibag. These nodules are peculiar to *manat soils* and are invariably found in them. The analysis of these nodules shows that they contain 24·12 per cent. of *iron oxide* and 10·89 per cent. of manganese.

8. A sample of locally prepared sodium nitrate was received from the Superintending Engineer, Dhrangadhra State. It contained nearly 12 per cent. of Nitrogen.

9. The Superintendent of Kumta Farm sent a sample of castings of certain sea animals, which he says are washed ashore in large quantities. The sample contained 1·25 per cent.

Nitrogen and 12·67 per cent. Phosphoric acid. If the material is available in large quantities it will be a useful manure.

10. During the period under report some samples of Ammonium sulphate were received which contained only 49 per cent. of ammonium sulphate while the rest of the material was mostly sodium chloride. When artificial manures are bought it is better to get them analysed so as to ascertain their purity per cent.

11. Some samples of waters were received from the Director of Agriculture of the Baroda State. The waters are used as manurial material for tobacco plants. The manurial value of these waters depends on the nitrates they contain. The soluble salts in these waters are large and hence they are diluted with other waters before putting them on land. The most typical out of these gave 1,010 parts of total soluble salts per 100,000 parts of water containing 28·35 parts of Potassium nitrate and 147·38 parts of Sodium nitrate.

12. A large number of samples of grapes were done for the Horticulturist to the Government of Bombay. The average quantity of reducing sugar was found to be 16 to 18 per cent. while the Kali Sahebi variety gave 22 per cent. of reducing sugars.

13. Samples of Saccharine matter found on Jowar leaves were sent by the Plant Pathologist and the Director of Agriculture of the Hyderabad State. The material contains 85 to 90 per cent. of sucrose, and about 3 per cent. of reducing sugars.

14. A sample of bran of an uncommon type was received for analysis. It had a good white appearance and had a soft slightly soapy feel. On analysis it was detected that the bran contained as much as 15 per cent. of sand which was mostly talc powder. It was a very ingenious adulteration.

15. Pods of Acacia tomentosa were received from the Veterinary Department through the Economic Botanist. It is reported that there are two varieties of Acacia tomentosa and the Mina variety is poisonous. On analysis it was found that the pods contained Hydrocyanic acid.

16. Some samples of new milk were done for the Agricultural College Dairy to find out how the milk changes from the first milking till its composition becomes constant.

17. Two Bazaar samples of powders recommended for dusting as a remedy against the leaf curl disease of chillies were sent for analysis by the Plant Pathologist. In one case sulphur was present to the extent of 38·4 per cent. only and the rest of the material was charcoal powder while in the second case the sulphur was found to be 54·07 per cent. and the rest was all ordinary earth. It is best for the people to buy pure sulphur and dilute it with fine earth themselves so that they may not pay heavily for ordinary earth.

18. Ashes of the *Ain* tree roots were received for analysis. The ashes were found to contain a large quantity of lime.

INVESTIGATION WORK.

19. Some pot experiments were done at Karjat in connection with the use of forest leaves for rice land. In these experiments some pots were given leaves which were rotted previously in a pit while others were given fresh leaves. The rotted leaves did not show any advantage over the fresh leaves. In another series the pots treated with rotted and fresh leaves received lime to neutralise the acidity produced by the decomposition of leaves and it was found that pots with lime added, gave better yields than those to which lime was not added. These results concur with experiments carried on small plots. Experiments with bone-meal showed that rice crop responds to the addition of bone-meal. It was reported from some places that large quantities of leaves used as manure lower the yield of rice. Experiments have been arranged to ascertain the cause and remedy the bad effects. Experiments are also being conducted with regard to the kind of Nitrogen the rice plants utilise best. These experiments are being conducted by Mr. D. M. Ranade, Senior Laboratory Assistant.

20. A study of the various chemical constituents of the rice plant at various stages was taken up two years ago by Mr. V. J. Atgur to find out their relation with the transplanting age of the rice plants and also to determine the time before which all the manure supplied must be available, to the plants. This has been completed and will soon be put together for publishing.

21. The chemical study of soils and waters in connection with the red-rot disease of sugarcane at Amalsad was continued. In the year 1920-21 the fields were not flooded with river water as usual during the rainy season and there was no red-rot attack and so it was thought that the floods were perhaps responsible for the appearance of the disease but in the year 1921-22 the sugarcane fields were flooded thrice but the red-rot did not appear. The analysis of the flood water at high and low tide, and of water standing in the fields after the floods had subsided, showed that the waters did not contain any harmful salts. Whatever be the cause, the red-rot disease did not make its appearance since the chemical study was started and this work, at least for the present, must be taken as closed.

22. The work in connection with the improvement of the cardamom crop is being continued by Mr. G. M. Bapat under Sir Sassoon David Trust Fund. The special feature of the work during the period under report was the study of the protozoa in the Sirsi garden soils.

23. The study of the decomposition of the trap rock is progressing, but naturally the progress of such a work cannot but be slow. Mr. N. V. Kanitkar, Assistant Professor of Chemistry is in charge of this problem.

24. The question of the utilisation of the mowhra flower refuse after distillation was referred to the Laboratory in the beginning of 1921. It was stated in the last report that the material soon goes mouldy but if care is taken to dry it well, it can be fed to cattle. In order to find out the other uses to which the material can be put, further work was taken up in hand. It was found during the experiments that if the material is treated with very dilute sulphuric acid under three atmospheric pressures the carbohydrates are turned into fermentable sugars. By actual trials it has been found that the sugars thus formed all ferment. Details of the preparation of alcohol from the refuse have been worked out and the chemical side of the question has been completed.

25. Preparation of *Gul* from cocoanut juice has been tried. The analytical work in connection with the gul samples is just complete and the report of the work is being written. Mr. V. G. Patwardhan was in charge of this work.

TEACHING.

26. I was responsible for the teaching of Geology and Chemistry to all the classes of the College. The work of teaching is growing every year and last year it was more than could be managed by the existing staff. This high pressure was relieved by the appointment of a Demonstrator in Chemistry from June 1921. In addition to teaching work of 20 to 22 hours a week every one of the teaching staff utilises his spare time in investigation work.

MANURE MIXING FACTORY.

27. According to Government order No. 7,790, dated 27th July 1918, R. D., a chemical laboratory is attached to the Union Agency with a view to encourage the use of manures by preparing mixtures of manures for the various crops and trying them on the fields of the cultivators. Mr. V. N. Gokhale, B.Ag, B.Sc., was in charge of this Laboratory during the period under report except for two months when he was on leave.

28. The analytical work done in this Laboratory included samples of manures sent by the Union Agency in their usual dealings as also the manure mixtures which they prepared. The soil samples were chiefly from the plot intended for experiments. The total number of samples analysed was 76 and may be classified as follows :—

Soil	..	..	15
Artificial manures	..	..	20
Manure mixtures	..	..	29
Organic and Miscellaneous manure	..	..	12
			76

29. The crops selected for experiments for the year 1921-22 were (1) Potatoes, (2) Chillies, (3) Onions, (4) Rice, (5) Betel vine and (6) Jowar. The experiments with *kharif*-potatoes, jowar, chillies and betel vine had to be given up on account of insufficient rainfall. Experiments with other crops showed that the crops were benefitted by the use of manures.

30. Results with the rice crop were as follows :—20 pounds of Nitrogen in the form of ammonium sulphate were given.

	Grain. Lbs.	Straw. Lbs.
1. Lonavla—		
Manured	1,480	1,840
Unmanured	800	1,560
2. Karjat—		
Manured	1,120	1,160
Unmanured	1,000	970
3. Belgaum—		
Manured	2,392	....
Unmanured	2,040	....

Potato (Rabi) experiments were conducted at Chakan, Khed and Belgaum. The Khed plots did not give any appreciable difference between the manured and unmanured plots. The results of Belgaum and Chakan plots are given below. In addition to the usual quantity

(20 cart loads) of farm yard manure, artificials worth Rs. 60 per acre were given. The artificials contained 8 per cent. Nitrogen, 5 per cent. Phosphoric acid and 9 per cent. Potash.

	Manured. Lbs.	Unmanured. Lbs.
Belgaum	17,360	15,120
Chakan	9,675	9,265

31. Experiments with onions.

In these experiments in addition to the 20 cart loads of farmyard manure artificials worth Rs. 40 per acre were given. The results obtained are given below :—

	Manured. Lbs.	Unmanured. Lbs.
(1) Chakan	10,600	8,120
(2) Nasik	15,000	9,525

Water-finder work.

32. This work was transferred to me in November 1920. As in 1920-21 Mr. B. M. Joshi, M.Sc., of the Chemical Laboratory, was put in charge of the field tests with water-finder. The machine has become very popular. The demand for the machine is increasing every year. During the period under report there were 190 applications. For the last few years a temporary staff was annually sanctioned under the powers delegated to the Director of Agriculture. But now the Director cannot sanction such a staff and unfortunately there is no provision made in the budget for 1922-23 for entertaining any staff for the water-finder and if no provision is made in the supplimentary budget this very useful and popular work will have to be closed down. Even during the last two months of the season ending in May 1922 the water-finder work was carried on by Mr. Joshi as an assistant in the Chemical Laboratory.

33. The work was started as usual in November but had to be closed earlier on account of the cloudy weather during the latter half of May and there was a break of one month in December as the water-finder machine was lent to the Bombay Development Department during that month. During the working period the machine was used for 30 persons and 174 spots were tested. The details are given in the following table :—

Name of District.	No. of villages visited.	No. of persons for whom work was done.	No. of spots tested.	No. of spots where indications of water current were given.
1 Ahmednagar	2	2	9	1
2 Belgaum	2	2	23	8
3 Bombay	1	1	5	*Nil.*
4 Dharwar	2	2	6	2
5 Nasik	5	2	18	4
6 Poona	8	11	55	14
7 Sholapur	1	1	10	3
8 Thana	2	2	11	1
9 State lands				
(*a*) Gwalior	1	1	9	2
(*b*) Jamkhindi	1	1	6	2
(*c*) Kolhapur	1	1	4	1
(*d*) Mudhol	5	4	18	6
Total ..	31	30	174	44

I am glad to say that all my assistants worked very satisfactorily during the period under report.

D. L. SAHASRABUDHE,
Acting Agricultural Chemist, B. P.,
Poona.

APPENDIX J.

WORK DONE UNDER THE ECONOMIC BOTANIST FOR THE YEAR 1921-22.

During this year the new arrangement, whereby all plant disease work is under the Plant Pathologist and all fruit work is under the Horticulturist, came into force. The work of the Economic Botanist now consists of botanical teaching and investigation of the special problems of Economic Botany. This term is one of wide meaning and includes, with regard to commercial plants, all problems which do not come strictly within the limits of pure agriculture, pathology or horticulture. Some of these problems are mentioned in the following paragraphs.

Dr. W. Burns, Economic Botanist, was on leave out of India for eight months,—October to May inclusive. During this time Mr. G. B. Patwardhan, Assistant Professor of Botany, acted for him, and Mr. L. B. Kulkarni acted in Mr. Patwardhan's place. Mr. H. P. Paranjpye was appointed District Horticultural Officer under the Horticulturist. His place now vacant in the Economic Botanist staff was not filled up owing to financial stringency. Proposals have been made for filling it, as the need of a man to take Mr. Paranjpye's place on the Economic Botanist's staff is badly felt.

While on leave Dr. Burns carried out in Edinburgh University some work on the technique of drought resistance investigation, and delivered lectures on Indian Botany to the Botanical Society of Edinburgh, the advanced students of the Botanical faculty, the staff of the Botanical Department of the Edinburgh University and to other bodies.

Mr. D. V. Narayanayya was appointed to act in the place left vacant by Mr. R. K. Bhide who now holds the appointment of Plant Breeding Expert.

EDUCATION.

The number of men in their final year of the degree course who specialised in Advanced Botany and Horticulture was six. All passed, and two stood first class. These six men made tours to Dharwar and Karjat to study cotton and rice breeding respectively. Wheat breeding was studied in Ganeshkhind Botanical Garden. Since no provision has been made for students tours in the current year this valuable means of instruction will be dropped.

Indian officers of the Army Training School come here in four batches and were given demonstrations. Students and staff of various schools and Colleges paid visits and were shown the work done in this Department.

The teaching of all the classes in the College continues to improve, as we gather material, and accumulate more charts, photographs, microscopic slides, etc.

The agricultural nature of our course is never lost sight of. The aim of the botanical teaching is to teach the student how to get the most out of the plant as a productive machine.

RESEARCH WORK.

Fruit.

Work under this head is now in the hands of the Horticulturist. One small research into the nature of the flowers of the Papaya has however been continued. This has resulted in a detailed description of the various types of male flower, which will be of value in breeding work.

CANAL WEEDS.

Considerable progress has been made in this investigation undertaken at the request of and with the collaboration of the Irrigation Department. The Mutha Right Bank and the Nira Left have been the two canals studied. These two canals differ a good deal both in their engineering and their botanical aspects. Some weeds are common to both, and some are peculiar to one, while of those common to both some are predominant in one place and not in other. Our main problem has been to determine the main factor in weed distribution, and hence the main factor in weed extirpation. Among engineers there appear to be two schools of thought, one of these considers silty water a cure for weeds, and the other considers deposited silt the main cause of weeds. As the matter is still under investigation a final statement cannot be given, but the evidence from the two canals above mentioned tends to show that where there is no silt there are no weeds. This would seem to indicate that if silt could be reduced so would the weeds.

The actual siltiness of the water is being determined weekly, and the nature and life history of the weeds are being studied. In addition direct experiments of growing certain weeds in moderate sized tanks with and without silt are being planned.

OTHER AQUATIC PLANTS.

As an example of the many special problems presented to the Economic Botanist, which require a good deal of exact local and laboratory investigation, we may mention the case of the Singoda plantation at Prantij in the Ahmedabad District.

The people there complained that the cultivation of this plant, Singoda (Trapa bispinosa) had various bad effects on the human beings and cattle of the villages near the tank where this plant was grown. Its cultivation is in the hands of a certain community there who make a fair amount of profit from it. The Economic Botanist was asked to determine whether or not these complaints were well founded.

Investigation showed—

(1) That the Singoda plants were no more harmful than other aquatics.

(2) That they are not responsible for mosquitoes.

(3) That the tobacco spraying of these plants, which was one of the grounds of complaint did no harm to the cattle and might probably harm the mosquito larvae.

(4) That as the Singoda was cut yearly stagnant water did not result therefrom.

The complaints were therefore found not to be well founded, and the authorities concerned were able to take necessary action.

The water hyacinth (Eichhornia crassipes) which is a pest in some other parts of India and in other tropical and subtropical countries was observed in quantity for the first time in the Mutha and Mula rivers near Poona and reported by the Economic Botanist. This staff has been swept down by the floods. Its main harm is done by blocking up tanks and backwaters.

Its appearance in such places should be watched for and dealt with.

SEED TESTING.

This department is not yet used by the public as it should be. The majority of samples examined come from Government farms. One interesting case of substitution of weed seed for a crop seed was sent in during the year, and it is understood that legal action is being taken on the report supplied.

Seeds were also identified for medico-legal purposes being sent from among the contents of stomachs, etc.

Special tests are now being made to test conclusively the length of time our chief crop seeds will live in store under good conditions. Such figures, based on much experience and hence accurate, are available in other countries for their main seeds but here these figures are still to be produced. We are on the way to produce them. The crops whose seeds are thus being examined are :—

(1) Bajri.	(7) Maize.	(13) Wheat.
(2) Jowar.	(8) Til.	(14) Safflower.
(3) Mug.	(9) Rala.	(15) Cotton seed.
(4) Matki.	(10) Ground nut.	(16) Linseed.
(5) Udid.	(11) Tur.	(17) Kabuli (White gram).
(6) Kulthi.	(12) Gram.	

Special tests are also being made of wild grass seeds in connection with the use of these for re-seeding depleted pasture lands. The percentage of germination is on the whole very low. The explanation of this is now being sought. The lowness of the germination percentage is not the same in all species however and some of those with higher percentages may possibly be of use in our work of renovating grass lands.

PLANT BREEDING.

Work under this head as done by the Economic Botanist has been purely for the purpose of giving students practive. The plants used have been cotton, maize and hollyhock. Each of these affords some special advantage from the teaching point of view. In the work on maize an interesting albino (white coloured) variation has appeared and its progeny are now being studied. In the case of cotton a cross between Khandesh and Kumpta cotton is the subject of work and in hollyhock the isolation of pure races for colour in the flowers.

For serious work of directly economic importance some valuable material has been put into our hands in the shape of 22 pure lines of safflower, presented by Mr. A. Howard, of Pusa and this material will be grown and studied with regard to the demands of the Bombay Presidency.

HERBARIUM.

The Herbarium is a collection of dried and mounted plants of the Presidency and some from outside it. It is most valuable for reference in the many cases when we are called on to name wild or cultivated plants. These specimens unless taken special care of rapidly deteriorate in this climate. During the year these specimens have been resorted and re-poisoned with corrosive sublimate against insect attacks. Seventy-five new sheets were added to the Herbarium. Two hundred and seventy-three plants were identified for Government and the public.

SASSOON DAVID TRUST FUND RESEARCHES.

(*I*) *On the improvement of poor grass land.*

Following up last year's work on the enclosed area at Kalas, a similar series of observations

have been made during the current year. The general result of these is that the vegetation is undoubtedly changing particularly in two directions.

(*a*) The establishment of tuft-like perennial grasses on the shallow slopes of the hilly parts.

(*b*) The increase in quality and quantity of the perennial grasses on the lower parts.

The soil moisture of the various layers is being studied, and the root habit and spread of certain species is being followed.

The plantings made at Sirur were only partially successful on account of the poor rains there. The study of individual species both in the field and nursery has been continued. Considerable data are to hand regarding the four villages, Dighi, Dhanori, Kalas and Moshi whose grazing lands were specially reconnoitred. Experiments at Tegur, Bankapur and Chharodi are in progress.

(*2*) *On the eradication of certain weeds and specially Lavala* (*Cyperus rotundus*).

In this research there has been much progress. We have now proved that the plant can and does propagate itself from seeds as well as tubers. Tubers germinate best when planted 9 to 18 inches below the surface. Below 2 feet there is little germination but some extraordinary cases were found of individual tubers being able to send shoots to the surface from a depth of 3 feet. Constant removal of the aerial parts indicates that in from 7 to 12 weeks the tuber producing these shoots is exhausted *and dies*. Exposure to the sun for ten days in May has also been proved fatal to the tuber. Spraying with chemicals has not yet given definite results and is being continued.

(*3*) *On the production of a race of Bajri* (*Pennisetum typhoideum*) *more drought resistant than the average of the races now grown.*

The first year of this work resulted in the collection of plants from the districts selected on account of the way they resisted drought. The original collection of Mr. Chibber was grown and observed on the lines followed by him. As a result we are now almost sure that hairiness of leaf, colour of nodes and sheaths, earliness of ripening and some grain and earhead characters are heritable. Some of the types were self fertilised to give pure seed for the next generation.

The morphology of the Bajri plant was closely studied. This study resulted in showing the general standard of each character. We know what percentage of plants usually tiller, the amount and number of grains to be expected from one earhead, etc.

Fortnightly sowings to determine effects of climate have shown that in the case of plots sown from November to the end of March the interval between sowing and first flowering was rather great (*i.e.*, $2\frac{3}{4}$ months), while in the case of later sown plots it gradually decreased.

W. BURNS,
Economic Botanist.

APPENDIX K.

ANNUAL REPORT OF THE PLANT BREEDING EXPERT FOR THE YEAR 1921-1922.

STAFF.

I held charge of the office of the Plant Breeding Expert to Government of Bombay, Poona, throughout the year. Messrs. S. G. Bhalerao and N. M. Nitimargi, graduate assistants, were in charge of the Rice and Wheat breeding stations at Karjat and Poona respectively. Messrs. G. G. Patil, K. R. Mhasavade and G. H. Joglekar worked as non-graduate fieldmen, the former two with Rice and the latter with Wheat. Mr. Patil formerly working with Wheat at Poona was transferred to Karjat for Rice work owing to the resignation of Mr. Athalye last year. Mr.Thakar also resigned his post owing to ill health in December. Mr. Joglekar was appointed in place of Mr. Patil and Mr. Mhasavade in place of Mr. Thakar. Mr. Dongre continued to look after the clerical and account work in the office till June.

PROGRESS OF WORK.

Rice.—Soon after I took charge of my office last year it was decided, at the instance of Dr. H. H. Mann, the Director of Agriculture, that I should prepare a detailed scheme for continuing the work on rice for the year under report. A committee consisting of Dr. H.H. Mann, as president and Dr. W. Burns, Economic Botanist, Bombay, Poona, Mr. V. G. Gokhale, Deputy Director of Agriculture, Konkan, and myself, was appointed to discuss the details of the scheme to be drawn out by me. The scheme was accordingly discussed by the Rice Committee who met for the purpose at Karjat on April 30th 1921. It was wholly approved with slight additions suggested by the different members, and I take this opportunity to thank the members for their valuable suggestions.

Season.—The condition of the season during the year under report had been very unsatisfactory and especially so round about Karjat. The rains were scanty during the seedling stage of the crop and although the experimental seedlings on the Farm grew vigorously as they were hand watered, still their transplantation was delayed to a certain extent for want of timely rain. This was a common complaint round about and resulted in a great reduction of the crop yield all over the tract. But as the Rice Breeding Station is situated in the neighbourhood of a hill-fed stream, and as some storage of water could be made by temporarily bunding the small pool of water where the late Mr. Chibber had proposed to construct an irrigation tank, the Farm did not suffer so much on this account as the generality of the cultivators, who had no water facilities of any sort.

Plan of Work.—Of the numerous Kolamba strains selected by the late Mr. Chibber for various desirable characters two were mentioned last year as considerably early in ripening and eight as very promising as regards yield. This information was based on the general behaviour of the selected strains in comparision with others for the two preceding years. But as these strains had not been proved to be absolutely pure as yet, it was necessary for me to make a close plant to plant study of their progeny to determine their purity and also to test their comparative merits along with those of the samples ordinarily grown by the cultivators. It was absolutely necessary in the first place to avoid all possible sources of obscurity and doubt, such as accidental mixture in the seed, and chances of natural cross-fertilisation. Having taken all possible precautions in these respects, the next thing was to grow the ten selected strains separately as pedigree cultures. So the eight high yielding strains were grown in three different series, *viz.*, in good, medium and poor fields respectively to study their behaviour under different soil conditions. The two early strains were also grown in three series but they were grown in a different field as they required slightly different conditions of moisture.

Bagging the earheads in rice for preventing natural cross-fertilisation, generally results in enhanced sterility due to failure of fertilisation of a number of flowers in the earhead. So in several cases only a small number of seeds of a bagged plant was available for sowing the individual cultures. This was especially the case because it was thought desirable to sow each ped gree culture from seeds obtained only from a single unbroken earhead of a bagged plant. Instead of taking seeds from several earheads of a plant for sowing, it was purposely taken from one earhead only, as in so doing there was no chance of accidental mixture ; and, it would represent the pure or hybrid nature of the parent plant as truly as if seeds from all the earheads of that plant were taken. Besides if seeds from more than one earhead had been used the work would have increased enormously. Already the three series of the ten cultures comprised more than 5,000 plants and it would have been impossible to make detailed observations with more, with the staff that was available then, especially as much of the work has to be done in the rain and in the midst of muddy fields and in more or less malarious conditions.

The seedlings for the pedigree cultures were grown in special bamboo trays filled with fresh soil to avoid mixture in the seed bed through washing from plot to plot. The seeds were dibbled at equal distances ; so there was no crowding and the plants could grow normally. They were hand watered whenever necessary. They were afterwards transplanted singly

together with the tillers produced by each, in rows. The distance between the plants was 9 inches and between the rows 18 inches. An extra foot was allowed between two separate cultures. Wide spacing between the rows was necessary for an easy movement through the plants for recording observations, although it was likely to encourage better plant growth than under normal conditions. Hence some allowance will have to be made on this account while considering the yield. To facilitate taking notes every fifth plant in the row was numbered. Detailed observations including counts, measurements and weighings were made with regard to several important plant characters both in the field and in the laboratory. This was carefully done on each of the 5,000 plants and their separate parts. Special attention was paid to such characters as are intimately connected with yield, *viz.*, tillering power, size and density of the earhead number of fertile and sterile flowers borne by it, weight and dimensions of the mature grains and total grain yield of each plant. General observations were also made regarding such points as liability to insect or fungoid diseases and tendency to standing or lodging. Frequency distributions of the various characters have been carefully worked out and graphically represented. More detailed report about the work will be soon ready for a separate publication.

The Rice Committee except Dr. Burns who was on leave, met again on April 20th 1922 to consider the results of the intense study undertaken to determine the purity of the strains. They were on the whole satisfied with the manner in which the work had been carried out and the results obtained.

The following is the summary of the results obtained and subsequently endorsed by the Rice Committee.

Five pedigree cultures, two early and three high yielding, have shown great constancy in all the important characters studied and they are considered to be pure. One was indeterminable this year as the number of plants available for study in each of its series was comparatively very small. Two were doubtful as regards their purity, and two proved to be actually impure, as they showed great diversity as regards certain important characters such as length and density of the earheads and size, shape and weight of the grains. It is gratifying to note however, that three high yielding strains and one of them in particular have actually given 20-30per cent. or greater yield as compared with the samples ordinarily grown by the cultivators although the conditions were decidedly unfavourable this year. The early strains which were studied mature full one month in advance of the late ones and they can profitably replace some of the early varieties that are grown in the high lying fields where the water dries up rather quickly. They are also good as regards yield.

The selected strains were also grown on a somewhat extensive scale (the area for each varying from 1,100-1,400 square feet) on the Farm, along with several samples of cultivator's seeds to compare the yields of the two and in most cases the superiority of the selected strains was evident when the comparisons were brought to work on an equal basis. It is to be regretted that there were inequalities in the two sets intended for comparison in respect of the areas planted, distance of planting size of bunches, etc., as sufficient area was not available and as the planting was done after the cultivator's fashion. It is intended next year to avoid all these inequalities and to plant equal sized bunches at measured distances in rows, so as to make the comparisons between the two sets as accurate as possible.

The following are the tables of yield, (1) calculated per acre on the basis of the average of the mean yield per plant obtained in the three series of each of the cultures, and (2) calculated per acre on the basis of the yields obtained in the extensive cultures of the same grown on the farm :—

TABLE I.

Average of mean weights per plant obtained in the three series, and yield per acre calculated on that basis.

Strain No.	Series.	No. of plants in each series	Average of mean weight of grain per plant in the three series.	Average weight of straw of plant in the three series.	Yield per acre calculated on basis of 43.560 plants per acre and average in Col. 4.	Straw weight per acre.	Whether pure. impure or doubtful.
1	2	3	4	5	6	7	8
			Grams.	Oz.	Lbs.	Lbs.	
6	1 2 3	259 250 242	31·48	1·17	2,494	3,223	Doubtful.
32	1 2 3	36 88 46	47·66	1·39	4,509	3,821	Indeterminable at present.

TABLE I—*concld.*

Strain No.	Series.	No. of plants in each series.	Average of mean weight of grain per plant in the three series.	Average weight of straw of plant in the three series.	Yield per acre calculated on basis of 43,560 plants per acre and average in Col 4.	Straw weight per acre.	Whether pure, impure or doubtful.
1	2	3	4	5	6	7	8
34	1	151	32·33	1·29	3,070	3,539	Impure.
	2	220					
	3	302					
35	1	128	38·12	1·09	*3,646*	3,117	Pure.
	2	67					
	3	131					
36	1	150	33·76	1·05	3,166	3,008	Impure.
	2	174					
	3	179					
42	1	258	35·13	1·17	*3,358*	3,220	Pure.
	2	248					
	3	265					
45	1	154	30·93	1·50	*2,878*	4,109	Pure.
	2	192					
	3	290					
72	1	118	39·66	1·43	3,646	3,921	Doubtful.
	2	254					
	3	103					
Early Strains 79	1	112	26·78	0·60	*2,494*	1,629	Pure.
	2	120					
	3	149					
Early Strains 110	1	118	26·64	0·72	*2,494*	1,948	Pure.
	2	117					
	3	108					

As stated in the body of the report some deduction will have to be made from these yield figures on account of the extra space given to the plants and on account of the probable error ; but it is also true that some consideration will have to be made for the fact that these yields are calculatedonthe basis of single plant per bunch, whereas the cultivators generally put many more, and even admitting that single plants tiller better, still they cannot thereby make up what they lose in the original number.

TABLE II.

Yields obtained in the extensive cultures and per acre yields calculated therefrom.

Strain No.	Area in square feet in which grown.	Number of bunches planted in the area.	Actual yield in lbs. and Oz. obtained in the area.		Yield per acre or 43,560 square feet calculated from columns 2 & 4.	Whether found pure, impure or doubtful in pedigree cultures.
1	2	3	4		5	6
			Lbs.	Oz.		
6	1,107	1,066	58	0	2,282	Doubtful.
32	1,134	913	78	12	2,996	Indeterminable at present.
34	1,404	1,088	86	14	2,668	Impure.
35	1,404	1,182	89	12	*2,761*	*Pure.*
36	1,404	1,117	92	8	2,854	Impure.
42	1,404	922	123	8	*3,841*	*Pure*.*
45	1,404	956	90	0	*2,792*	*Pure.*
72	1,404	1,235	104	14	3,226	Doubtful.
Early Strains 79	810	804	41	6	*2,205*	*Pure.*
Early Strains 110	962	879	41	14	1,854	*Pure.*

*On the whole this strain has given satisfaction from all points of view and in all tests.

In order to have a confirmatory evidence about the high yielding and superior quality of the selected strains their seeds were also supplied to a few local cultivators for trial this year on their own lands on an extensive scale, and they were asked to report if they considered them profitable. In almost all cases they were impressed with the superiority of the selected strains and able to make good reports about them in spite of the bad season and the reducing effect of the late transplantation. As a result of their experience this year, there have been more numerous and voluntary demands for seed from the cultivators in the neighbourhood for sowing in the ensuing season. But before issuing the strains throughout the whole of the Kolamba tract it will be necessary to multiply the stock of pure bred seeds, so as to be able to meet the increasing demands adequately. It is therefore proposed in the first place to supply pure seeds for growing on condition of preserving purity, only to some reliable cultivators every year, and to purchase the produce from them when harvested. This will now be done not only round about Karjat but also in a few distant places in the Kolamba tract. This will not only facilitate multiplication of the seeds of the selected strains but it will also help to ascertain their suitability to the whole of the Kolamba tract. The seeds purchased from the cultivator can be used for further distribution during the following year. It is in this way alone that a regular supply of tolerably pure seed can be maintained to meet the increasing demands until some seed growing agency comes forward and takes up this work.

Other reserve strains.—Besides these tested strains a number of other Kolamba and non-Kolamba strains selected by the late Mr. Chibber are being grown to preserve their seed and will be taken up for future testing in course of time. A collection of the principal varieties of the Bombay Presidency is also maintained for further trials.

Wheat.—It is a serious disadvantage to have to change the sites of experimental plots every now and then as the investigator cannot adjust his plans and operations to the new conditions all of a sudden without some previous experience about those conditions. It is therefore to be regretted that the wheat plots had to be shifted from the Poona Agricultural College Farm during the year under report as there was no area available for growing them there. They had therefore to be located at the Ganeshkhind Botanical Gardens, Kirkee; and thanks are due to Dr. W. Burns, Economic Botanist, and Mr. G. Cheema, Horticulturist, for allowing me to make use of some land at that place for my wheat investigation. The area available here measured about one and a half acres only. It consisted of two plots side by side of which one alone was fairly good and level, but the other poor and sloping. The soil was medium black, of fair deapth in the better plot and the situation was open to irrigation from a canal. The plots were manured with thirty cart loads of farm yard manure and other refuse, and ploughed cross ploughed and harrowed before the rains, so that they might receive all the rain water without allowing it to be washed off. Small irrigable beds of suitable size and water courses were made at the end of September and as there had not been enough rain before, the land was lightly irrigated. Another light irrigation was given ten days before sowing which was commenced on the 20th of October. The crop was irrigated thrice during the actual period of growth; the first of these irrigations was given 10 days after sowing, and the other two at intervals of a month each. After every irrigation the land was properly mulched by scraping the upper surface with a sickle as soon as conditions became favourable.

From the field notes already taken by the late Mr. Chibber, promising strains had been selected from a number of cultures for growing this season. These were mostly from the hard yellow macaroni type of wheat. The main idea this year was to take actual plant to plant measurement regarding the various important characters of the different strains in order to determine their purity, which had not been done so far. The seeds sown for this detailed study were always from one individual plant. The number of seeds sown to represent each strain varied from 150 to 200 only. More seed for this purpose was not available from one plant as the plants were not irrigated last year and as they had not produced sufficient number of earheads. The seeds were dibbled at the distance of six inches in the row and the rows were placed one and a half foot apart. Every culture occupied four rows in all and every bed contained three such cultures. Every 10th plant was numbered in order to facilitate taking plant to plant notes. Duplicates of all the above cultures were sown by the drill in the usual way to get an idea of the general stand and productiveness of each. The drilled cultures were not however sown from seeds of one plant alone as in the case of the dibbled series, but seeds from several plants in the same culture were used for this purpose. It is to be regretted that area was not available for growing the cultures on a sufficiently extensive scale.

The germination appeared to be satisfactory but in the beginning the very young growing shoots in the dibbled series were badly injured by surface grass hoppers. Attempts were made to check this trouble by poisoning the grass hoppers but to no purpose. Later on as the seedlings became older several of them one after another were affected in the different cultures by the soil Fungi Rhizoctonia and Fusarium. Most of the affected plants either died in course of time or became very much stunted and produced very few and poor earheads. In this way although the germination was satisfactory in the beginning the plants that actually survived in each dibbled culture were only about 50—60 per cent. of the seeds previously sown, but really speaking only about 40—45 per cent. grew normally. The result was that most of the cultures showed a

number of gaps. Consequently the remaining plants derived unequal advantage of space : and while the more favoured ones grew better, those which were affected by the soil Fungi and which were not completely killed grew more or less miserably. The trouble from the soil Fungi mentioned above appeared to be less in the case of the drilled series and especially so in the poorer plot. It may be that the deaths in the drilled series were not easily noticed owing to the larger number of seeds sown, and perhaps the soil Fungi did not get favourable conditions in the poorer plot for their development. Later on there was a good deal of trouble from the stem borers also and a number of earheads in several cultures had dried up without producing grain. These were all removed as soon as noticed together with the insects and the culms on which they appeared. Black rust made its appearance in a bed of miscellaneous types at the time of flowering but the attack was very mild. It only appeared in a few plants in a place where water used to collect at the time of irrigating. Affected plants were immediately destroyed. Smut was also noticed in a few strains here and there but its occurrence was negligible. The affected plants were uprooted and destroyed as soon as noticed.

Detailed study of the selected strains.—A number of strains were grown for trial but thirty seven of them were studied in detail to determine their purity. Plant to plant measurements were taken regarding the following important characters in each, *viz.*, height of plant, tillering power, leaf dimensions, size and density of the earheads, average number of seed per earhead, seed dimensions, absolute weight of seed and weight of seed per plant. Attention was also paid to such characters as standing or lodging and susceptibility to disease. From the data collected in this way, frequency distributions regarding the various characters in each strain were worked out and the mode mean and co-efficient of variability noted. On the whole most of the strains taken up for the detailed study might be considered as pure. It is true that the frequency curves of some characters were not quite normal in some of them. But if we take into consideration the disturbing influence of the various causes mentioned above and of Rhizoctonia and Fusarium in particular, there is no reason to suspect the actual purity of the strains, simply because of the increased variability of some characters of fluctuating nature. As already stated the effects of these Fungi on certain plants were so great as to cause great stunting of their growth or their ultimate death, and without such external influence the plants would certainly have behaved normally. Indeed exceptng the two Khapli strains which have actually split into various types this year there was no strain which could be definitely pronounced as impure.

Out of the thirty seven different strains studied in detail, as many as 14 pure and promising strains with fairly normal frequency distributions and having many superior qualities have been sorted out by means of a score card system, those carrying the highest number of marks under each desirable character being ultimately isolated for further trial. These will be grown on a larger scale as well as studied in detail once more for comparing their yields with those already obtained or with those of the samples grown by the cultivator.

The following is the summary of observations regarding the various strains :—Nos. 26, 27 and 52 noted as having bright yellowish green leaves and bright seed bred true to that character but unfortunately this year they proved to be particularly susceptible to the trouble from Rhizoctonia and Fusarium in the dibbled series, No. 52 being also affected in the drilled lot. Nos. 157 and 284 were waxless as in last year, they were strong in straw, had good tillering capacity and were rather good in yield. But they also showed great liability to trouble from the soil Fungi. Of the strains mentioned last year as being early Nos. 168 and 171 were found to be early by 10 days as compared with others. Besides their earliness which is a very desirable character, they tiller well, the quality of their seed is good and they are also rather good in yield. The two Khapli strains, one with Kala Kusal characters and the other with brown coloured glumes proved to be impure as they split into several types. However these different types will be studied further to see if any of them remain constant and prove to be useful. From the Kala Kusal type, strain No. 278 has given good results as regards yield and vigour of growth and No. 280 again proved to be strong in straw. But these strains are late in ripening and rather risky on that account. They also show liability to suffer from the soil Fungi. Of the good yielders Nos. 210 and 212 were again confirmed as satisfactory regarding yield. No. 162 also showed a high mean yield per plant but there was a very wide difference between the mode and mean and its yield in the drilled series was also rather low. Strains which were not mentioned before and which have given some promise regarding good yield this year are Nos. 186, 284, 299, 103, 167, 200 ,224, 228 and 237. The first three of these have shown higher mean yield per plant than the rest, but they also show a wide difference between the mode and mean owing to the fungus trouble. No. 186 has however given a high yield in the drilled series though Nos. 284 and 299 are uncertain in this respect, as their drilled series happened to be grown in poor soil and gave low yields.

In the above conclusions as regards yields, mean or average yield per plant calculated on a sufficiently large number of individuals has been taken as an additional basis for comparison this year. The single basis of yield obtained from an area of 100 sq. ft. or so without reference to the actual number of plants present is likely to be deceptive owing to the variable number of plants in the different cultures. Thus while some of the high yielding strains mentioned last

year, whose yield was calculated on the latter basis alone did not prove to be so this year, others which were not mentioned before behaved well now. It is therefore intended to pay particular attention to such strains as have proved satisfactory in both these tests and to treat such as have passed one test only as secondary. Thus from the table of yields given below it will be seen that Nos. 167, 224, 228 and 237 deserve special attention. They were represented in the dibbled series by a pretty large number of plants, they have shown high mean yield per plant, their modes and means also are not very widely separated and their drilled series have confirmed their yielding capacity.

Needs of the wheat work.—It is desirable to have some permanent accommodation for the seed store, laboratory and quarters for the staff. The present arrangement is only temporary and not very convenient for work. It is also desirable to have more good land where extensive cultivation can be tried, and the yielding capacity of the promising strains thoroughly tested on a large scale.

In conclusion I appreciate the careful and industrious way in which Mr. N. M. Nitimargi, Superintendent of the Wheat Breeding Station, carried on the work and the willingness with which his staff helped him.

R. K. BHIDE,
Acting Plant Breeding Expert.

APPENDIX L.

ANNUAL REPORT OF THE WORK DONE UNDER THE PLANT PATHOLOGIST TO GOVERNMENT OF BOMBAY, POONA, FOR THE YEAR 1921-22.

STAFF.

I held charge of the post of Plant Pathologist throughout the year. The staff remained the same as last year with the following exceptions :—

Mr. G. S. Kulkarni, M.Ag., Assistant Professor of Mycology, went to England on the 1st of October 1921 on deputation for one year to work in Plant Pathology at the Royal College of Science and Technology, London, and Mr. B. N. Vakil, M.Sc., has acted for him from 15th November 1921.

The posts of temporary non-graduate fieldmen for Koleroga work have been made permanent during this year and Messrs. S. A. Jamadagni and S. K. Gaikwad, the incumbents, have been confirmed in them.

In addition to the above, the services of Mr. J. D. Ranadive, B.Ag., were placed at the disposal of the Plant Pathologist by the Potato Committee for assisting in the Mycological work in connection with Potato rot studies.

All the staff have worked satisfactorily.

RESEARCH.

(*i*) *Study of the diseases of the Potato Crop.*—Some work on the potato wilt (Fusarium oxysporum ?) done by Mr. G. S. Kulkarni before he went to England on deputation in October 1921, confirmed the parasitism of this fungus and its distinctness from the dry rot Fusarium, but the study of the behaviour of the wilt disease caused by it and of the means of combating it has had to be postponed till Mr. Kulkarni's return.

The study of potato rots in storage was directed mainly to the determination of the characteristic effects of the various suspected physical and biological causes of the rots and evidence was obtained which throws considerable doubt on the correctness of identifying the " Heat Rot " described in Bulletin No. 102 of the Bombay Department of Agriculture with the " Black Heart " of American authors. The symptoms described as " Heat rot " appear to be the combined effect of certain Fungi Fusarium, Rhizoctonia (Sclerotium Spp.) and bacteria, acting vigorously at the high temperatures obtaining in potato storage. These symptoms are not produced when heat alone (even upto 42° C.) is allowed to act on the tubers in the absence of micro-organisms ; and they are found to occur at the lower temperature of 85° F., which has been previously regarded as a suitable temperature for checking " Heat Rot ". Study of the temperature relations of the fungi associated with the rots further showed that some of them, the Dry rot fungus (Fusarium trichothecioides ?) for example, thrive best at the low temperature 85° F. No treatment of tubers with fungicides is found to be certainly effective in keeping out or destroying the rot fungi. The solution of the problem of potato storage has, therefore, to be sought, it seems, in still further reduction of the temperature of storage.

(*ii*) *Work on Cotton Wilt.*—This was directed mainly to testing the susceptibility of seven selected strains of cotton isolated by Mr. Kottur (Cotton Breeder, S. D.). A plot on the Dharwar Farm was deliberately infected with the wilt fungus and the strains under trial were grown in it. Wilted plants were sent to the Plant Pathologist, week after week, for examination throughout the season and the percentage of attack noted in the case of each variety. The following is a tabular statement of the results :—

Serial No.	Variety.	No. of plants grown.	No. of plants wilted.	Percentage of attack.
1	Dharwar No. 1	2,641	1,013	38·35
2	Dharwar No. 2	1,349	76	5·63
3	Dharwar No. 3	1,375	758	55·1
4	Dharwar No. 4	1,191	661	55·49
5	Dharwar No. 5	1,183	854	72·19
6	Wagale	1,288	61	4·73
7	Kumta	1097	245	22·33

It will be seen that the strains Wagale and Dharwar No. 2 have shown considerable resistance to the disease.

Susceptibility of bushy and tall types of Cotton.—At the request of Mr. M. L. Patel, Cotton Breeder, N. D., the susceptibility of Surti Broach C 1 (tall types), Selection I-A (Bushy), Ghogari E 5 (Slightly bushy) and Ghogari B 21 (Bushy) to Fusarium wilt attack was tested in pot experiments. All the varieties were equally attacked and no difference in susceptibility between the tall and bushy types as was believed to exist was seen.

(*iii*) *Leaf spot and blight of Onion.*—This disease is characterised by spotting and drying up of the upper parts of the leaves which results in the imperfect development of the bulbs. It has been described by the Konkan Agricultural Staff as being the main obstacle in the extension of the cultivation of this crop in North Kanara. Owing to the distance from the headquarters of the locality, and to the limitations of staff and time, it has not been possible, in previous years, to obtain a clear idea of the cause and course of the disease from the few scattered observations that could be then made. Mr. Kamat, B.Ag., Assistant Mycologist, was, therefore, deputed to Kumta early in January 1922 to study this disease on the spot. He remained in the locality for nearly three months and has been able to obtain much useful information which may be summarised as follows :—

(1) The disease is caused by a fungus, a species of Alternaria. The attack by this fungus is probably facilitated by an attack of thrips.

(2) Of the five varieties of onion tried in North Kanara, each obtained from a different locality (Gokak, Nasik, Goa, Poona and Surat), the one from Gokak was found to be the most susceptible to the disease and the one from Surat the least susceptible. Again, in all the varieties, the red forms were seen to be less susceptible than the white forms.

(3) Thin planting appears to prevent the disease, while thick planting encourages it.

(4) Different manurial treatments show no effect on the degree of disease.

(5) The disease makes its appearance nearly a month and half after transplantation (*i.e.*, from the 3rd week in January to the first week in February) and the progress of the disease is most rapid in cloudy and warm weather.

(6) Some preliminary experiments with spraying with Bordeaux mixture indicate that it may be used with success as a preventive though not as a curative remedy for the disease.

(7) The disease is found to be more severe in the coastal regions than in the interior.

(*iv*) *Miscellaneous observations on Crop diseases.*—Mr. B. N. Vakil, Acting Assistant Professor of Mycology, has determined the cause of a reddening of leaf sheaths of the Pundya variety of Sugarcane, reported from the Belapur estate and suspected to affect the growth of the plants, to be Cytospora Sacchari Butl. The disease however has not turned out to be of any importance. He has also made some observations on a Fusarium-caused wilt (" Foot rot ") of wheat and a collar rot of Brinjals and Chillies which was associated with the fungus Sclerotium Rolfsii (formerly known as Rhizoctonia destruens).

The study of a dieback disease in a Citrus garden at Loni has been undertaken in collaboration with the Horticulturist. The cause of the disease has not yet been determined, but a Diplodia-like fungus was developed copiously from the affected roots. This will be studied along with the other Diplodias isolated previously, as time permits.

Observations on the peculiar leaf-spotting of Sugarcane referred to in the last year's report were repeated by Mr. H. G. Metha, on the Manjri Farm, in consultation with the Plant Pathologist. The cause still remains unknown. The disease is believed by the Imperial Mycologist, Pusa, to be the same as that described as " Leaf Scald " in New South Wales. It does not do any appreciable damage to the crop at Manjri, fortunately.

Experiments with the Smut on Nachni (Eleusine Coracana) were again carried out during the year under report at Malkapur, District Kolhapur, and on the College Farm, and were directed to discover the mode of infection and the possible method of dealing with the disease. The seed was mixed with spores and then divided into two lots, one being steeped in 2 per cent. solution of Copper Sulphate for 10 minutes and the other left untreated. At Malkapur the crop from the treated lot showed no smut while that from the untreated lot showed some of the grains smutted. Although the affected ears were very few in number the result obtained shows that the infection in the case of this smut is from spores adhering to the seed and also that it is amenable to the copper sulphate treatment. Quite apart from the effect of steeping on smut attack, a rather surprising, though still unaccounted for, result of the treatment may be noted here. The crop from the treated seed grew strikingly more luxuriantly than that from the untreated seed, the average height of plants in the former being nearly double that of the latter. The crop grew very poorly on the College Farm, very few heads were formed and no smut appeared in either the treated or the untreated plot.

The spraying trials against the Powdery mildew on Jeru (Cuminum Ciminum) were repeated at Nadiad and gave the following results :—

Place.	Area.	Treatment.	Actual yield from the plot.	Calculated yield per acre.
			lbs.	lbs.
Government Farm, Nadiad ..	5 Gunthas	Sprayed with Bordeaux mixture.	33	264
	8 ,,	Unsprayed ..	40	200
Agricultural Association Plot, Nadiad ..	5 ,,	Sprayed ..	39	312
	5 ,,	Unsprayed ..	37	296

These results show that the spraying is beneficial. The use of the normal Bordeaux mixture, however, leaves a rather narrow margin of profit at the present prices of Copper Sulphate, but indications have been obtained in previous trials that half normal strength of Bordeaux mixture would answer equally well, if applied judiciously, and further trials are necessary to test this.

The observations on the causes influencing the occurrence of "Red Rot" in sugarcane in Amallad tract in Gujarat planned last year could not be carried out owing to "Red Rot" not having occurred at all during the year under report.

Teaching.—The courses in Plant Diseases and Mycology for the B.Ag. degree and a short course in Plant Diseases to the Short Course Class were given.

Routine and Propaganda.—(1) 140 Specimens of Plant diseases received from members of the public and the Department were examined and reported on during the period under report. These included the following diseases either new or not previously recorded in the Presidency :—

(*i*) Piricularia Sp. on Nagli (Eleusine Coracana).

(*ii*) Ploesphaeropsis sp. on Fig and Guava suspected to cause a die-back of the host (identified at Pusa).

(*iii*) Uromyces Aloes (Cke) P. Magn. on Aloe vera (identified at Pusa).

(*iv*) Gloeosporium Sp. on Jack-fruit causing black spots on the rind.

(*v*) Puccinia Lolii on Oats.

(*vi*) Pythium Butleri on Papaya.

(*vii*) Sclerotium Rolfsii on Polyanthus tuberosum.

(*viii*) Cytospora Sacchari Butl. on Sugarcane.

(2) The spraying campaign against Koleroga of betelnuts was conducted in Honavar and Siddapur Talukas of North Kanara district and in Dapoli Taluka of Ratnagiri District. Altogether 13,810 palms were sprayed in these tracts. The extension of this propaganda is much handicapped by the insufficiency of staff and the difficulties of communication during the heavy rains to which the tracts affected by this disease are subject.

(3) Assistance in spraying was given as usual by the loan of sprayers and services of fieldmen, whenever possible, at the request of the cultivators. Demonstrations of Plant diseases were given in the laboratory to officers of the Army School, Belgaum, to students of the local training colleges, to visitors from the Agricultural and Co-operative Conferences and to other visitors to the College.

PUBLICATIONS.

(1) Observations on the Wilt Disease of Cotton in the Central Provinces by S. L. Ajrekar and D. V. Bal, Agricultural Journal of India, Vol. XVI, Part VI, November 1921.

(2) The Murda Disease of Chilli (Capsicum) by G. S. Kulkarni, Agricultural Journal of India, Vol. XVII, Part I, January 1922.

(3) Conditions influencing the distribution of Grain Smut (Sphacelotheca Sorghi) of Jowar (Sorghum) in India, Agricultural Journal of India, Vol. XVII, Part II, March 1922, by G. S. Kulkarni.

(4) A note on the susceptibility of Dwarf Milo Sorghum to Smut. Phytopathology, Vol. II, No. 6, June 1921, by G. S. Kulkarni.

(5) Smut-Ustilagoparadoxa Syd. et. Butl. on Panicum frumentaceum Roxb. by G. S. Kulkarni, Journal of Indian Botany, Vol. III, No. 1, 1922.

(6) The Smut of Nachni or Ragi (Eleusine Coracana), by G. S. Kulkarni, Ann. of Appl. Biol., Vol. IX, No. 3, 1922.

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Poona.

Poona Agricultural College,
July 19th, 1922.

APPENDIX M.

ANNUAL REPORT OF THE SOIL PHYSICIST TO THE GOVERNMENT OF BOMBAY, POONA, FROM JUNE 1921 TO JUNE 1922.

The work of my branch is divided into two sections, *viz.*: (1) Research and (2) teaching; practically no work of routine nature is accepted for want of staff. Help is however given to other branches where such help is necessary for the solution of problems in those branches. The imperial Bacteriological Department at Pusa wanted such help and it was given for the investigation of manat lands at Alibag. As the help thus given was found to be very useful and as no more work could be undertaken by me for want of staff the Assistant Bacteriologist at Pusa has offered to come here and work in this Laboratory with me.

RESEARCH.

The main line of research work undertaken is with the ultimate object of checking as far as possible famine in food grains and fodder in those parts of Bombay Presidency where rainfall is precarious and irregular. This can be done, as far as soils are concerned, by treating the soils in such a way as to make them store as much of the rain water as possible, so that more water may be made available when it is needed for the proper growth of the crop, especially in the rabi season.

The simplest and the most recognised practical way of doing this is (1) to level the land if it is not fairly level, (2) to plough the land deep just in the beginning of the rainy season, if not earlier, in order that the rain water may find easy access down into the soil, (3) to put on bunds where necessary in the field and (4) to keep, by repeated harrowing a soil mulch on the surface of the land to prevent evaporation.

Experiments on these lines could not be undertaken for want of regular staff and grant but every possible help and advice is given to those private gentlemen who want it.

At Nagar H. K. Patwardhan, Esquire, B.A., LL.B., was very anxious to carry on dry farm experiments on his estate and asked for advice and guidance which is being given to him without any reserve.

On Government Seed-Farm at Mohol in Sholapur District a very small beginning is made on the above line of work but systematic work on a fairly large scale can be undertaken if more facility is forth coming.

At present Laboratory methods are being tried to test the Physical properties of the soil and to find out means to increase the water holding capacity and the amount of available water in the soil.

Soil from Mohol was therefore brought to Poona and submitted to physical and chemical analysis (with the help of the Agricultural Chemist).

The figures of analysis are as follow :—

Physical Analysis.

Finest silt	..	4·86	These particles tend to make the soil stiff for tillage operation.
Fine silt	..	8·83	
Medium silt	..	12·04	
Coarse silt	..	15·92	These particles tend to make the soil lighter for tillage operation.
Fine sand	..	55·82	
Coarse sand	..	2·53	
		100·00	

The proportion of clayey material to sandy material is as 25·73 : 74·27 and hence the soil may be classed as " Sandy-loam ". Such soils are known to be good for dry-farming. This is also borne out by the results of a few physical tests given further on.

The figures of chemical analysis are as follow :—

Soil from Mohol (District Sholapur).

	Per cent.
Stones	9·00
Moisture	6·62
Loss on ignition	9·00
Sand	53·42
Lime (CaO)	3·72
Potash (K_2O)	0·15
Phospheric acid (P_2O_5)	0·10
Nitrogen	0·09

These figures show that the percentage of Potash and Phospheric acid in this soil is rather low.

The soil from Mohol was also treated with several organic and mineral menures. The quantity used was about 4 tons of organic manure and 1½ cwt. of mineral manures per acre—six inches of soil.

The change in the hygroscopic co-efficient, maximum water-holding capacity and capillary power was then observed.

The results are given in the following table :—

Mohol soil.	Hygroscopic Co-efficient.	Maximum water-holding capacity.	Capillary power in millimeters.			
			17th February 1922.	25th February 1922.	3rd March 1922.	18th March 1922.
			24 hours.	8 days.	15 days.	30 days.
Untreated soil	15·56	82·76	195	555	680	864
Treated with farm yard manure	15·16	84·27	166	498	634	821
Fish manure	15·46	83·97	181	433	520	665
Goat manure	14·98	82·92	146	452	560	720
Mowra refuse	15·77	83·06	180	487	595	770
			21st March 1922.	28th March 1922.	4th April 1922.	19th April 1922.	23rd May 1922.
			24 hours.	8 days.	15 days.	30 days.	53 days.
Ammonium sulphate (N-21 per cent.)	16·04	87·06	170	415	530	700	920
Sodium nitrate (N-16 2 per cent.)	16·01	88·65	112	275	375	549	794
Superphosphate (Soluble P_2O_5 19 per cent.)	16·25	89 31	142	365	462	609	785

The table shows that by the addition of organic manures no material change in the hygroscopic co-efficient is effected ; on the contrary the tendency seems towards a decrease in the hygroscopic co-efficient except in the case of mowra refuse (this may perhaps be due to want of complete decomposition of the manures which were allowed to decompose in the soil for six weeks). Of the three mineral manures used, superphosphate gave the highest results increasing the hygroscopic co-efficient of the original soil by about 0·7 per cent.

The maximum water holding capacity of the soil as will be seen from the table can be increased both by the addition of organic manures or by the addition of mineral manures. Of the organic manures used farm yard manure has given the highest result increasing the maximum water-holding capacity from 82·76 to 84·27 per cent., *i.e.*, about 1·5 per cent. where as of the mineral manures superphosphate gave the best results increasing the maximum capacity by about 6·5 per cent.

In order to see whether superphosphate has the best power of increasing the maximum water-holding capacity of any kind of soil, similar experiment with mineral manures was made on the Pandharpur soil with the following results :—

Pandharpur soil.	Maximum water holding capacity.
	Per cent.
Untreated	43·63
Treated with ammonium sulphate	48·40
Treated with sodium nitrate	46·50
Treated with superphosphate	47·17

It will be seen that in the case of Pandharpur soil ammonium sulphate has given the best result. It appears, therefore, that these manures act differently on different soils and no general rule can be laid down.

In the case of both of these soils, however, mineral manure have increased the water-holding capacity by about 5 to 7 per cent.

Comparing now the figures of the capillary power it will be seen that the height to which capillary water can rise is reduced by the addition of organic manure as well as by the addition of mineral manure. Not only the height but also the rate of rise of capillary water is also showed down by such treatment, untreated soil showing the highest and quickest rise of all.

By examining the above three physical properties of the Mohol soil, *viz.*, hygroscopic co-efficient, maximum water-holding capacity and capillary power, it appears that the soil, as it

is, is fairly good for dry farming as far as these properties are concerned. If it is found necessary and profitable the maximum water holding capacity can be increased by the use of farm yard manure or superphosphate or better perhaps by the mixture of both of these manures. By such treatment, however, the capillary rise may be reduced to some extent but it is not likely to be very detrimental for the proper growth of the plant, for within certain limits as the fertility of the soil is increased less water is consumed by the plant. The soils at Mohol are found to be, on the spot, fairly deep for dry farming. On the Government Seed-Farm the variation in depth is from 2 to 4 feet or more; the latter depth is preferable. Of the other physical properties of this soil, which are of importance for dry farming, *viz.*, available water evaporation co-efficient, etc., are being done. Bouyoucos' dilatometric method for finding out the available quantity of water in the soil is being very carefully tried. Results have been obtained for differently treated soils but they require further corroboration and cannot be given at present.

The other piece of research work, that was undertaken, was with the object of finding out how the moisture contents in a piece of land at the Agricultural College Farm vary during four months of rabi season, *viz.*, September to the end of December. The moisture contents in the soil were examined at different depths such as from surface to 3", 3" to 6", 6" to 9" and 9" to 12". These depths were different affected by occasional showers of rain as will be seen from the following figures :—

	Moisture in surface to 3".	Moisture in 3" to 6."	Moisture in 6" to 9."	Moisture in 9" to 12."
	Per cent.	Per cent.	Per cent.	Per cent.
1st September 1921	15·9	17·2	17·7	18·1
(Rainfall of 33 cents was recorded on the 19th September 1921 when the moisture contents were changed as follow)				
19th September 1921	22·3	26·6	26·0	22·4
3rd October 1921	14·4	17·3	18·3	17·0
(Rainfall of 20 cents was recorded on the 10th of October when the changes in the moisture contents were as follow)				
10th October 1921	19·5	21·4	23·0	20·8
17th October 1921	15·2	16·6	21·0	21·0
23rd November 1921	7·7	7·5	5·5	7·7
20th December 1921	5·3	5·3	4·8	5·7

If we compare the figures of moisture contents on 19th September when they were highest with those on 20th December when they were lowest we find that the greatest variation in the moisture contents due to rain, etc., occurs in the depths of 3" to 6" and 6" to 9" of this soil. Similar work on the land ploughed deeply and covered with soil mulch by frequent harrowing would give an idea as to how much rain water it is possible to absorb and retain in a field. The work cannot be undertaken for want of trained staff.

TEACHING.

Teaching soil physics to the students of the Intermediate Agricultural Class formed a part of my duty. Students practical work in the Laboratory is carried on under the supervision of a Demonstrator who consults me whenever necessary.

STAFF.

For one year, *i.e.*, from February 1921 to March 1922 my Scientific staff consisted of only one non-graduate assistant on Rs. 40 per mensem, who by careful study and diligence, had just become useful to me. On the 1st of March of this year, however, owing to the retrenchment policy he was suddenly asked to go away and I had to lose him also. At present therefore I have not a single assistant to help me and it has become extremely difficult to make material progress in my work. From May 1922 I have been given a Laboratory boy on Rs. 16 per mensem, who having studied upto English 6th standard is likely to be useful as an assistant if he is kept on.

V. A. TAMHANE,
Soil Physicist, B. P.,
Poona.

APPENDIX N.

ANNUAL ADMINISTRATION REPORT OF THE DEPUTY DIRECTOR OF AGRICULTURE FOR ANIMAL BREEDING, BOMBAY PRESIDENCY, FOR THE YEAR 1921-1922.

Mr. Edward John Bruen held charge of the animal breeding operations during the year. He was on tour in the districts for 102 days, visiting likely areas and giving advice generally on cattle breeding and dairying. He was an Examiner at the last B.Ag. Examination. Considerable progress was made during the year, both in the investigation line and constructive work in the Districts. The village propaganda has reaped very satisfactory results and in many Districts, the people are now taking more kindly to cattle improvement. In some cases the people have volunteered their entire scrub bulls for castration, a very encouraging sign. Special mention may be made to the progress made in Dharwar District as a whole, the funds at the disposal of the Deputy Director being quite inadequate to meet the demands for Premium Bulls. It is however hoped that the Bankapur Farm will soon be in a position to meet this demand. Similarly in the Maswad Khillari tract, a great demand exists; this area will still have to be supplied from bulls purchased at Bazars of which we know nothing and it is extremely difficult to persuade people to use bulls of which neither this Department nor the people concerned know anything. Moreover, in both these tracts good bulls are getting scarce and very expensive. The District Staff have had to go into adjoining Native States to purchase good bulls and even here they are very scarce and expensive.

Owing to finance, this Department has concentrated its energies and resources to the Kankrej, Khillari and Mysore type of cattle, in the former breeding and the knowledge of breeding has helped a great deal, in the latter two areas, economic conditions have made cattle very expensive and the people are now beginning to realize that cattle breeding is essential. The other breeds, however, need immediate attention. Each year makes the problem more and more difficult.

The cattle breeding farms at Chharodi and Bankapur were periodically visited during the year. Owing to the late appearance of the rains, the Famine Cattle Camp at Perna (Dongargaon) in Poona District was kept going till August 1921.

The Deputy Director helped the Infants and Public Milk Supply Company, Limited, to reorganise their farm at Palghar and continual help and advice was given. The farm has extended its activities in Bombay by purchasing the Government Military Dairy and now the Company are selling milk to hospitals and the public. It is yet too early to see the results on the lines of work suggested.

The report is divided into two parts :—

(*i*) District Work.

(*ii*) Farms.

The District Work is again divided into :—

(*a*) District or Village Work.

(*b*) Premium Bulls.

(*c*) Shows.

DIVISIONAL DISTRICT REPORTS.

Northern Division.

This Division includes Gujarat, Thana, Nasik and both West and East Khandesh. Mr. D. S. Patel, Divisional Inspector of Cattle Breeding, held charge of the duties from the 22nd May 1921 till the close of the year. He visited in all 164 villages, holding meetings of all interested in cattle, lectures were delivered on the necessity of cattle improvement, methods of improvement, benefits of improvement, feeding, hay and silage making. In this Division, we have four classes of professional breeders, the Rabaris and Barwads breeding Kankrej, the Dang breeding the Dangi and the Tillari breeding the Tapti Khillari. All these professional breeders know their business but owing to pastures or grazing lands being given up to cultivation and the successive bad seasons since 1914, all these classes of breeders are now fast leaving their profession. Strange to say, in these tracts, we get some of the finest cattle in the Presidency and yet they are in comparison to other breeds appreciably low in value making the profession a very precarious one. The time has now arrived when either this professional breeder must be encouraged by setting aside adequate grazing or the cultivator must be induced to breed his own cattle.

The latter will be very difficult as caste prejudices of the cultivator must naturally interfere with cattle improvement. Very little success has been met with in these tracts, owing as I have said to the poverty of the professional breeder *plus* the dearth of grazing areas in suitable breeding tracts. However with all this a number of requests have been registered for bulls, which have since been put out. Divisional Inspectors visited eight private farms, Pinjrapols and Gow-Rakshans giving advice where necessary. It is encouraging to see that the Viramgam

Pinjrapol and the Dakor Temple Gow-Rakshan have taken the advice given and are now gradually putting their breeding on scientific lines. Three Cattle Breeding Societies were visited, advice was given where necessary. A great deal of up-hill work has yet to be accomplished before the confidence of the people, who have many old fashioned prejudices, can be gained. However, I believe, we are on the right track and results will not take long.

Premium Bulls.—During the year only four Premium Bulls were put out owing most probably to the semi-famine conditions prevailing. Nine applications out of 27 were selected to give bulls in the Thana District. The Divisional Inspector visited the Mhasa Fair to purchase these but owing to the non-attendance of the applicants, the bulls were not purchased.

In this Division, two fine breeds of cattle, the Dangi and the Tapti Khillari, are still without Government Farm to grow breeding bulls on. Very little improvement can be done by breeding from bulls of which nothing is known and this Department cannot confidently encourage persons taking bulls of which they are not certain.

Shows.—In the Division three cattle shows were held, one at Chharodi with an attendance of 400 head, one at Shirpur with an attendance of 200 head and one at Ghoti with an attendance of 63 head. The success of the shows cannot be judged by the number of cattle attending. The breeders attended in numbers to see what was actually going to happen as rumours were afloat that it was only an inducement to collect cattle which were going to be forcibly purchased. The value of such shows depends largely on their continuity. Unless they are held regularly, good or bad seasons, no results will be obtained. However, it was very encouraging to see after the people had settled down the interest that was taken in each class of animal exhibited.

Central Division.

Mr. G. V. Hardikar held charge of the duties of the Divisional Inspector of Cattle Breeding for the year. He held charge of the Famine Cattle Camp at Perna (Dongargaon), District Poona, till August 1921 doing the management and purchase of cattle. During the year, the Divisional Inspector visited 61 villages, where lectures, etc., were delivered. The breeding in this Division differs a great deal from the Northern Division, here the breedng is done by the cultivator himself or I should say by cultivators who are favourably situated as to grazing and climatic condition. In this Division, we have only one pure breed known as the Maswad Khillari, although another breed known locally as the "Nakli Khillari" is to be found. This breed has been bred by continual cross of the Khillari proper and the Gowti or village cattle, after generations of careful breeding the breed is now to all intents and purpose a pure breed. The great difficulty in this division as far as the cattle breeding areas are concerned is the very frequent recurrence of famine. However, good prices are realized for good cattle and the people are fighting against great odds to carry on cattle breeding.

There exists a great demand for good bulls, which are getting scarce and naturally expensive.

Premium Bulls.—During the year 32 applications were received for Premium Bulls. Of these eight bulls were given out. The Divisional Inspector visited the Maswad and Nagoba Fairs and Chinchli Fair but owing to a dearth of good bulls only a limited number could be given out. A farm to breed bulls of this breed is urgently required.

The Divisional Inspector visited all Cattle Breeding Societies in his Division and gave advice where necessary.

Cattle shows.—During the year seven Cattle Shows were held in this Division :—

Serial No.	Village.	Taluka.	District.	No. of cattle attending.
1	Mahud Bk.	Sangola	Sholapur	180
2	Wadegaon	Do.	Do.	228
3	Balavdi	Do.	Do.	140
4	Tisangi Sonke	Pandharpur	Do.	173
5	Tandulwadi	Malshiras	Do.	144
6	Bhamburdi	Do.	Do.	63
7	Kopargaon	Kopargaon	Ahmednagar	75

The first six shows are for the Maswad Khillari breed and are situated in the indigenous breeding grounds of the breed. Here again the entries are no criterion of the usefulness of such shows. These shows were started this year, after lapse of six years. The people were very keen and interested. My predecessor have worked in this tract for some years and the notable feature of the shows was the exhibits of the progeny of bulls given out by

Government. The show at Kopargaon was not a success, this was however expected. The show was really held to see what could be done in cattle breeding and improvement of the cane growers. Here, however, no attention is paid to breeding, the people only being interested in having good bullocks, which are purchased for all over the Presidency. It is my opinion that shows are essential to good cattle breeding and that they must be held regularly. However, I would recommend only holding one central show for this area as by holding only local village shows, the main object of comparison between the effects of good bull is lost. The progress made in the Central Division is very encouraging.

Southern Division.

Mr. S. K. Angadi held charge of the duties as Divisional Inspector of Cattle Breeding, S. D., during the year. From April to June 1921 he was on Faimine Cattle Camp duty at Rahuri in the Ahmednagar District. He held charge of the segregation section of the Camp. He toured the Sholapur and Bijapur Districts, giving help and assistance to the Revenue Department with their Cattle Camps. In July 1921, the Divisional Inspector took up his regular duties. He visited 85 villages in the Dharwar, Belgaum and Bijapur Districts, where the objects of this department were explained, lectures on cattle breeding, management, etc., were delivered.

In this Division, we have three pure breeds of cattle indigenous to the tracts in which they are found (*i.e.*) the Krishna Valley and the Maswad (or Atpadi Mahal) Khillari. In the Dharwar and Bijapur Districts, the Amrit Mahal or Mysore breed is fancied ; this breed is very well adapted to the condition and in the few instances, where breeding is conducted equally as good results as those in the indigenous home of the breed are obtained.

The aspect of cattle breeding or rearing is here again totally different to the other parts of the Presidency. Here the bull or bullocks of the three breeds are very expensive ranging from Rs. 200 to Rs. 600 per bullock. I have seen several pairs of bullocks valued at from Rs. 1,800 to Rs. 2,000 per pair. The breeders in the Krishna Valley have been doing their business very successfully for generations and require little teaching or encouragement, except with the assistance of good pedigree bulls. The Khillari breeder is also a careful breeder and knows the value of good breeding but is not so careful with his methods of feeding.

In the Dharwar and parts of Bijapur Districts, the question is not so easy. The cultivator has been driven to producing his own cattle owing to the high prices he has had to pay for his cattle. He now realizes the necessity, but knows little or nothing of the business, however, this will be gained in time and with the help of this department very good results should be obtained in a few years. There is ample fodder to be found, the only difficulty being that it is coarse, which naturally means a big waste, the introduction of chaff-cutters is being advocated.

A big portion of the Dharwar District comprises a tract known as the Malad tract. Here the question is much more difficult. The cultivator is poor and the climate totally unsuited to rearing, raising or breeding any of the existing pure breeds. It is my opinion that a breed will have to be evolved either by out-crossing of the indigenous breed or breeding from selection of the indigenous cattle, one or the other of these forms of improvement is essential as the existing cattle are so poor that the cultivator will not or cannot afford to pay any attention to this very necessary side of this business and I am afraid will not, till some improvement is brought about.

The Divisional Inspector visited six Cattle Breeding Societies and gave all help and advice. He also visited regularly three private Cattle Breeding Societies and has been able to introduce in these the keeping of records so essential to good cattle breeding.

Premium Bulls.—Very good progress has been made in this Division. Eleven Premium Bulls (Cow) and one Buffalo-Bull were put out during the year considering that this is the first time anything has been done in this line. Over 30 applications were received for bulls but only 11 bulls were found suitable although the Divisional Inspector visited five large Cattle Fairs for this purpose. The bulls are all doing excellent work and the people are all very satisfied with them.

Shows.—Owing to partial famine conditions prevailing only three cattle shows were held at Yedur, Savdi and Ainapur. These were a huge success, Government aid being given in the case of Savdi and Ainapur. The people were so keen and interested that shortly afterwards a show was held at Yedur by the Athni Agricultural Association, the prize money being obtained by public contribution.

Serial No.	Village.	Taluka	District.	No. of cattle attending.
1	Savdi	Athni	Belgaum	255
2	Ainapur	Do.	Do.	233
3	Yedur	Chikodi	Do.	317

It is very encouraging to see the interest taken by the public. Mr. S. S. Mangsoli, a breeder of Athni, who takes a great interest in cattle improvement, has been very useful to this Department in this area.

SUMMARY.

The Deputy Director of Agriculture for Animal Breeding attended as many of these Shows as possible. In the Southern Division Jatras or Cattle Fairs have been in vogue for many generations. It is believed that the good cattle to be found in this Division is due to the influence or part played by these Jatras. The Three Divisional Inspectors have all worked very well and have made great progress in introducing a new line of business to many parts of the Presidency.

Statement No. I gives the number of Premium Bulls put out by this Department during the year under report.

Statement No. II gives the total number of Premium Bulls put out since 1919.

I have been ably assisted by all my staff. The work undertaken has been new to the country and many obstacles have been overcome.

My clerical establishment have worked very well, having undertaken and carried out the famine camp work, which was directly administered to from this office. A great deal of work was put on the office establishment owing to the Cattle Committee. My office work has been ably managed by Mr. V. K. Gokhle, Head Clerk, and his staff men; with this extra work all my other office work has been kept up-to-date.

STATEMENT No. I.

Statement showing Details of Premium Bulls put out in 1921-1922.

Serial No.	Village.	Taluka.	District.	Kind.	Remarks.
1	Dakor	Dakor	Kaira	Bull.	
2	Do.	Do.	Do.	Do.	
3	Do.	Do.	Do.	Do.	
4	Rupavati	Sanand	Ahmedabad	Do.	
5	Peth*	Walva	Satara	Do.*	*Since sold.
6	Gondwaleh Bk.	Man	Do.	Do.	
7	Harigaon	Kopergaon	Ahmednagar	Do.	
8	Soa	Mahad	Kolaba	Buffalo-Bull.	
9	Godegaon	Pandharpur	Sholapur	Bull.	
10	Kavtali	Do.	Do.	Do.	
11	Do.	Do.	Do.	Do.	
12	Malshiras	Malshiras	Do.	Do.	
13	Athni	Athni	Belgaum	Do.	
14	Do.	Do.	Do.	Buffalo-Bull.	
15	Shivyog Mandir	Badami	Bijapur	Bull.	
16	Narayanpur	Shiggaon	Dharwar	Do.	
17	Hiremallur	Do.	Do.	Do.	
18	Kunimalali	Do.	Do.	Do.	
19	Matebennur	Ranebennur	Do.	Do.	
20	Taredalli	Karajgi	Do.	Do.	
21	Shiddenur	Hirekerur	Do.	Do.	
22	Karur	Ranebennur	Do.	Do.	
23	Dharwar	Dharwar	Do.	Do.	
24	Garag	Do.	Do.	Do.	

STATEMENT No. II.

Total number of Premium Bulls put out in the Presidency since 1919.

1919–1920.	1920–1921.	1921–1922.	Total.
7	10	24	41

Annual Report of the Northcote Cattle Farm, Chharodi, for the year 1921-1922.

Mr. M. M. Desai held charge of the Farm, Mr. B. B. Jamaspjina was Assistant Manager and Mr. M. G. Patel, a student under training.

OBJECT OF FARM.

The object of the farm is to breed pedigree stock of the Kankrej breed of cattle. Bulls are bred and put out on a premium system into villages desirous of improving their stock. When the Farm was taken over, a great number of undesirable cattle were present. Last year all the breeding bulls of unknown pedigree were disposed of and this year a great number of the cows, who had proved themselves undesirable from a breeding point of view were cast, and sold. The herd

is fairly uniform now as to type but to get maximum results further rigorous casting will have to be carried on to eliminate other than type faults in the breeding herd.

SEASON.

The Farm had to face another very poor season not only from a point of view of the late appearance of the rains, but the very heavy rains that did fall in the space of a few days. A few cents of rain was recorded on the 25th June; until the 15th July when 1 inch was recorded, the Farm had no rain with another break up to the 20th July. From this date to the 31st July 11 inches and 52 cents of rain was recorded. This hampered the sowing operations a great deal. Advantage had to be taken of the small breaks to carry on the sowing and other farming operations and then only the high lands were get-at-able. The kharif sowing actually started on the 18th July and was finished on the 2nd August. During this period some 56 acres were prepared and sown. The Farm is low lying and this very heavy rain meant that a considerable area was practically flooded for weeks. This water lying about naturally stunted the growth of the grass, killing the best varieties and encouraging the more coarse grasses, which are valueless from a fodder point of view. Owing to this water lodging mosquitoes and other pests appeared in great numbers, this together with the swampy conditions brought on by the rain set the livestock back a great deal. No less than 37 old cows succumbing to these very adverse conditions. Malaria was very bad for 3 months, the Manager and his complete staff were at one time or another down with fever.

CULTIVATION.

Crops.

It has been the object to make the Farm as self-contained as possible. No data being available for the production of fodder crop or other foodstuffs, several experiments are still in progress to ascertain what can be grown to advantage. The following were grown with their respective results :—

JOWAR AS A MONSOON CROP.

Sundhia, Sholapuri and Perio varieties.

The above varieties were sown. The actual sowing was commenced on the 21st July with Perio, Sholapuri been taken next and Sundhia last. These were all sown in the low lying patches fearing that they could not be got at later on. The remainder of the Farm being put down to Sundhia as time and rain permitted. This later sowing being followed by very heavy rain, the germination was very poor. The area had to remain and was eventually put down to Rabi Val and Castor.

Owing to the low lying nature of the land in which the Perio and Sholapuri were sown, have suffered a great deal from the stagnant water. Perio seemed to suffer a great deal whilst Sholapuri resisted these very adverse conditions very well.

COTTON.

A small area was sown by the Dibbling method to selection I A variety of Surat cotton but due to the excessive rain, a great deal of weeding had to be done. The monkeys also giving no end of trouble whilst the plants were in boles, this experiment proved that cotton cannot be grown favourably.

SUNFLOWER.

Sunflower having proved its value as a fodder crop for silage making in other countries, a small area was sown to Sunflower, the seed being obtained from the Union Agency. Unfortunately the seed was very poor and did not germinate. The seed was tested with the same result.

SUNDHIA AS A SUMMER CROP.

A small area near the Farm well was sown to Sundhia. Irrigation seems to be too expensive in this tract and the crop barely paid its way. However, it served the purpose of producing green oddfer for the young stock (Males) for which it was intended.

VAL AND CASTOR.

These areas that failed in the monsoon were sown to Val and Castor during the Rabi season, both these crops served the purpose for which they were intended. The Val (Dolichos Loblob) was poor seed and the germination was poor, however, with a fair amount of care, very encouraging results were obtained.

CROP PESTS AND DISEASES.

The crops in the year under report did not suffer from pests as in the previous year owing to the heavy rain however, due to this heavy rain leaf spot Fungus (Colleto-Trichum Graminicolum) made its appearance; this, however, disappeared as more favourable conditions appeared.

HAY, HAY-MAKING AND SILAGE.

The hay crop of the year fell a great deal from the average owing to water lodging and owing to the saturated nature of the soil due to the holding up of the excessive rain water by a bund

on the Farm, which is maintained to supply water to the adjoining rice lands of the several neighbouring villages. About 500 acres of grass was ruined due to this stagnation, and the harvesting implements could not be worked till November. One of the best grass paddocks situated near the bund produced practically no grass. The harvesting operations were taken in hand on the 16th November and completed on the 2nd March 1922. However, due to the Farm being fenced off into paddocks a fair out-turn was obtained from the higher paddocks of the Farm.

SILAGE.

The year proved a poor one for silage as stated, the land was too sodden to harvest the green grass in time to make really good silage.

MISCELLANEOUS WORKS.

Ecological survey of grasses.

(1) The experiment reported in the last report, is in progress, no further observations being made.

(2) A large Cattle Show was held on the Farm, which entailed a great deal of work on the Farm staff. The Deputy Director of Agriculture for Animal Breeding held a demonstration at the time of the Show, both these were a huge success.

(3) Owing to the annual appearance of Rinderpest, which accounted for the death of many cattle, it was thought necessary to have the young stock between 1 year and 3 years old inoculated by the serum simultaneous method. Some 194 young stock were protected against the disease. The cattle that were inoculated have been marked with an O brand on the hump. It is hoped that in time the herd will be totally immunized against the ravages of this disease.

BREEDING HERD.

Considerable progress has been made since the last report. The progeny from bulls of known breeding such as those of bull Mohan bred on the Surat Farm are a distinct improvement on the calves of previous years.

The milking experiment has been continued with very satisfactory results. Until proper arrangements for feeding and tethering the animals are made, the results will not be what they may be under more suitable condition.

Owing to the heavy nature of the rains, the livestock suffered a great deal and the late appearance of the rains necessitated the feeding of dry grass for a much longer period than usual. The inoculation interferred with the progress for a while. This particularly affected those cow whose calves were inoculated as they had to accompany and go through the tract with their respective progeny. All these had an adverse bearing on the results of the milking experiment. In all 110 cows were milked during the year.

BIRTHS.

During the year 131 calves were born as against 125 of the previous year, the percentage working out to 41·2 a very appreciable increase on previous years. A number of heifers of 4 years of age calved for the first time, this also proves that better feeding and care plays a big part in early maturity as in previous years, heifers were calving at 5 years or more.

The services have also increased considerably.

DEATHS.

During the year some 139 cattle of all ages died, old age and debility claim 59, no cattle were sold for the past two years and hence the big number of deaths from old cattle. Rinderpest claim 43, of these 30 were calves and young stock, the remainder were due to hurt of snake bite.

During the year 111 cattle of all classes were sold for Rs. 3,975.

Annual Report of the Cattle Breeding Farm, Bankapur, for the year 1921-1922.

Mr. A. B. Gadagkar, G.B.V.C., held charge of the Farm for the year under report except for a short period when he was deputed to purchase cattle for the Farm and Mr. S. K. Angadi, Divisional Inspector, carried on the work in addition to his own duties.

SITUATION.

As previously stated the Farm is situated in an old fort at Bankapur village, 12 milles from Hattimattur Railway Station on the Madras and Southern Maratha Railway.

OBJECT.

The object of the Farm is to breed pedigree bulls of the Hallikar type of Mysore breed of cattle.

SEASON.

The season as a whole was a good one, although the rains made an appearance rather later than usual.

CULTIVATION AND HAY-MAKING.

There is very little scope for cultivation on the Farm as the land is strewn with debris of old buildings and is intersected with large nullahs or drains, hardly an acre of land is level at present. It is hoped, however, to be able in time to get at least 10 acres of the area in a fit condition to grow fodder crops. The total area of the Farm being 112 acres, about 20 acres of this is occupied in Farm buildings and an old preserved temple, two other places of worship and old walls. The latter will in time be demolished ; this means half an acre per head of livestock.

GRASSES.

The area is covered with a fairly good growth of the following grasses :—

Abundant.	*Scanty.*
1. Andropogon Contortus.	1. Chloris Virgata.
2. Andropogon Foveolatus.	2. Ischæmum Laxum.
3. Apluda Varia.	3. Andropogon Annulatus.
4. Cynodon Dactylon.	4. Leguminosæ Calycina.
5. Panicum Miliaræ.	
6. Phaseolus Sublobatus (Legume).	

There are many other varieties but in too small quantities to make mention of them. Andropogon Contortus has at present established itself practically all over the Farm. The Kulkarni comb had to be used to remove the awns before the grass could be used. Andropogon Annulatus does not grow at present to any extent. A plot set aside for a grazing experiment proved conclusively that the cattle appreciate this variety of grass. The cattle in grazing this area picked out the Andropogon Annulatus before grazing anything else that is in its young state.

HARVESTING.

Owing to the uneven nature of the land the use of mowing machines has not been introduced but in a year of two it is hoped that a big area will be ready fit to use the movers. This year's harvesting was done by hand. The harvesting was commenced in September but had to be abandoned owing to rain. The total area was harvested at a cost of Rs. 642-10-0 and the total quantity harvested and stacked was 1,71,368 lbs. of dry grass or hay or Rs. 3-12-0 per 1,000 lbs. In addition to this 25,000 lbs. of green grass was cut and converted into silage, the silage costing practically the same as the hay, that is Rs. 3-12-0 per 1,000 lbs.

METHOD OF PRESERVATION.

Two pits were used for the purpose. One a hillside pit with ordinary rough sides and rammed bottom, this we shall call pit No 1.

Pit No. 2 was an old powder magazine.

Pit No. 1 measuring 8′ × 8′ × 10′.

Pit No. 2 measuring 10′ × 10′ × 15′.

Pit No. 1 contained 10,000 lbs. of green grass, this was fair although a wastage of one foot from the surface, 6″ at the sides and 6″ from the bottom was unavoidable owing to the rough nature of the pit.

Pit No. 2 being an old powder magazine was originally plastered. Here there was no wastage, the silage sinking down some 4 feet and packing well, whereas in Pit No. 1 owing to the rough sides the shrinkage was not 2 feet. It was very interesting to see how the cattle relished this silage in the hot season especially the young stock and smaller calves. It is presumed that the adult cattle had never had silage as they were purchased in villages. When the pits were opened each day, the cattle rushed in to their place of feeding.

EXPERIMENTS CONDUCTED.

Improvements of grass area.

The Farm reserved several plots for grass experiments. One plot for grazing to see results, one was protected against trespassers and a third plot was cut. No definite conclusions have been arrived at as yet.

CULTIVATION.

The only piece of land at present suitable to cultivation is the bed of an old tank 210 yards, by 150 yards. The plot was prepared and was sown to Sunflower but owing to the very poor quality of seed, it never germinated. The plot was recultivated and then sown to Maize, which produced 10,973 lbs. of green fodder, which was fed green to the young stock. Cultivation will be difficult on the Farm until the Farm gets rid of the swarm of monkeys that have taken up their abode on the Farm. Arrangements are being made to eradicate these by catching them and transporting them to the Kanara Forests.

IMPROVEMENTS.

Levelling and Clearing.

The Farm as stated above consists of uneven land and debris of old buildings, lantana and prickly pear. A great deal has been done in levelling the land and a sum of Rs. 2,097 was spent in removing the prickly pear and lantana.

Road.

A new road was constructed from the public road into the Farm, the old road not only being unsuitable but divided the area up badly. The old road, however, meets a very useful purpose, by admitting the building of a segregation yard, which is very necessary on a livestock farm.

Buildings.

The original buildings being inadequate for the Farm requirements, to meet these requirements, two cheap stone and mud lean to sheds were erected, one for young bulls and the other for calves. The former is enclosed in a woven wire fence and the latter in a walled in compound at a cost of Rs. 1,462-14-8. A third lean to shed is in progress for dry cows. To get the best results from livestock, it is essential that they be housed and fed separately. The Farm buildings with the exception of the Office and Store Room have been completed and have been taken into use. The Farm is still very short of servants' quarters, only four servants' quarters being provided in the original scheme, when the Farm was estimated for, the intention was only to keep 20 cows; this has now been increased to 100 and more servants are required and hence more accommodation.

WATER.

The water supply on the Farm was very precarious and during the last hot season, water ran short. Sanction was obtained to put down a bore, this was done at a cost of Rs. 850. This has now ensured a good and ample water supply. The site selected for the bore was on an elevated hill commanding the whole Farm. Arrangements are now being made to put up a supply tank and gravitate it to the required sites. No troughs were provided in the original plans, two troughs were however built this year.

IMPLEMENTS AND MACHINERY.

During the year a Myer's hand pump was purchased for the bore, this method however is very expensive. To overcome this difficulty, an engine was received by transfer from the Agricultural Engineer, together with a grinding mill. The kadbi grown in this locality is very long and thick, this has hitherto been chaffed by hand-power which is very expensive. A power chaff-cutter was purchased, which will be run off the engine mentioned above. For the present the Farm is in great need of a cart weighing machine to watch the progress of cattle and to weigh its produce.

BREEDING HERD.

The total strength of the herd at the end of the last year, *i.e.*, 30th June 1921, was 60 head. During the year under report 25 breeding cows and one breeding bull were purchased in Mysore at a total cost of Rs. 4,683 *plus* Rs. 717 Rail and other charges. A small Maswad Khillari herd consisting of one breeding bull, one young stock bull, four cows and four calves were purchased for Rs. 600.

Statement No. I gives in detail the herd present and its value at the end of the present year, *i.e.*, 30th June 1922. It will be seen from the statement mentioned above that during the year 43 calves were born, from a total of 56 cows, some of which came late and are still due to calve, the birth rate percentage works out to cent. percent.

Mr. A. B. Gadagkar and his staff have worked exceedingly well. The cattle have been well cared for and a great deal of spade work has been done. The Farm was practically free from any disease what-so-ever and only a death of a small calf is recorded. Mr. Gadagkar deserves great credit for the way, he has managed his Farm.

STATEMENT No. I.

Amrit Mahal Breeding Herd.

Year ending 30th June 1921.				Year ending 30th June 1922.									
Description.	Number.	Average value.	Total value.	Description.	On hand 1st July 1922.	Purchased.	Received by transfer.	Transferred.	Born.	Died.	Total.	Average values.	Total value.
		Rs.	Rs.										Rs.
Cows ..	27	185	4,995	Cows ..	27	25	4	..	..	..	56	185	10,360
Heifers ..	5	155	775	Heifers ..	5	..	7	4	..	..	8	155	1,240
Young Stock Bulls ..	4	100	400	Young Stock Bulls ..	4	..	10	..	..	..	14	100	1,400
Bulls ..	2	587	1,174	Bulls ..	2	1	..	..	..	..	3	587	1,761
Bullocks ..	4	300	1,200	Bullocks ..	4	..	..	..	..	..	4	300	1,200
Calves (Males) ..	11	85	935	Calves (Male) ..	11	..	..	10	20	1	20	85	1,700
Calves (Female) ..	7	60	420	Calves (Female) ..	7	..	..	7	23	..	23	60	1,380
Total ..	..	..	8,340	Total ..	..	..	..	..	43	1	128	..	19,041

	Rs. a. p.	Rs.		Rs. a. p.
Valuation, 30th June 1921 ..	8,340 0 0		Present value	19,041 0 0
Cattle purchased		8,340	Last valuation and purchase	13,623 0 0
Amrit Mahal		4,683		
Khillari		600	Increase in value	5,418 0 0
		13,623		

The breeding bull was purchased at Rs. 550 being young. I have appreciated it to the value of the others. The 25 cows were purchased at an average of Rs. 165-8-0 *plus* Rs. 717 Railway freight and other charges working out to Rs. 192, etc., but the same valuation as shown last year is taken. This counter-balances the depreciation on old cows.

APPENDIX O.

ANNUAL REPORT OF THE AGRICULTURAL ENGINEER.

I held the charge of the Agricultural Engineer's Office during the year under report ably supported by my Assistant, Mr. Paranjpe, and Boring Overseer, Mr. Chitale. This is the twelfth annual report of the Agricultural Engineer as a separate section of the Agricultural Department and during the last 12 years many important experiments have been made.

We have tested various methods of mechanical cultivation, water raising devices, cane crushing, shredding and baling, fodder, and boring. In fact our activities involve so much executive work now, that it is thought desirable to transfer most of the administrative work to the Deputy Directors of Agriculture. This will give me and my staff much more time for further developments on the lines previously indicated and also enable me to take up new lines, particularly implements. The latter branch of my work has been sadly neglected and to carry out the experimental and investigation work in this respect much of my time will have to be devoted to each problem in the field.

I give below a summary of the work done by this Department during the year under report in its various capacities.

POWER PUMPING.

The progress of agriculture in India calls for the application of the latest methods, but to educate the Ryots to the uses of these methods with the attendance of machinery for every operation takes a long time, and perhaps in no branch of the work of this Department is this truth so obvious as in power pumping, and the question, of course, naturally arises as to what we are doing in this direction. The procedure is as follows :—

On receipt of an enquiry the site is surveyed and estimates prepared, then drawings are prepared, machinery purchased, erected and tested and the owner is taught how to drive the machinery and attend to the plant properly. Afterwards men are sent to attend to breakdowns and assist in keeping the plant efficient and in good working order. Notwithstanding all this we have had failures, but we have also had successes and we are now in a position to say what is and what is not essential to success provided of course the owner is a man prepared to work himself and assist us in making the plant a paying proposition.

In this connection the Department has spent most of its energy and time in executing repairs, and making modifications to existing plants and fixin gsuitable pumping sets temporarily at places where the crop was likely to suffer during the repairs to existing plant.

The following are cases in point :—

(1) The engine at the Empress Gardens, Poona, broke down and a plant consisting of a 6 b.h.p. Wizard Engine and a 2½" Gwynne's Pump had to be temporarily fixed and worked for more than a week in order to save the gardens from great damage.

(2) Mr. Kokje's plant at Ranjangaon broke down last year and a 15 b.h.p. Crude Engine had to be fixed in its place and worked for a considerable time. His engine has now been put right and fixed in its original position. Delay was due to the fact that parts had to be imported from England.

(3) Mr. Kuber of Dahiwadi wanted his plant shifted to a new well as the old site was short of water. The spindle of his pump also gave way rendering it quite useless. Consequently a substitute from Poona was provided until his own plant was repaired and refixed.

(4) The pump at Turmuri, Belgaum District, belonging to Mr. G. B. Kulkarni also got out of order. The Impeller spindle had to be renewed along with the bearings at the Workshops and then sent to Turmuri and assembled.

(5) The 3 b.h.p. engine at the Agricultural School, Loni, had to be substituted with a 4 b.h.p. engine from the experimental well as the former was found to be overloaded.

(6) There was a call from Government House for emptying the swimming bath. An 8 b.h.p. Portable Steam Engine was hauled to the tank by means of one of the tractors and a 6" K. Type Pulsometer Pump temporarily fixed for the purpose of pumping out the water.

(7) In addition to the above the engines at the Bund Gardens, Poona, Government Farm, Jalgaon, and Government Farm, Manjri, went out of order and were repaired by this Department.

The experimental well required some modifications and alterations and the work undertaken in this connection is briefly as under :—

(1) A new vertical boiler fixed for working the Steam Duplex Pump and the Pulsometer Steam Pump.

(2) A 10 b.h.p. Ransome Crude Oil Engine has been fixed in place of the 6 b.h.p. Portable Ruston Engine as the latter is to be sent to the Surat Farm as a temporary measure.

(3) A Wizard Engine is fixed in place of the 6·6 b.h.p. Clayton Semi Diesel Engine on the 4th Bay to work the 2½" Vertical Spindle Pump.

(4) The "Aquatole" chain pump newly purchased was fixed on the 3rd Bay coupled to the 3 b.h.p. Blackstone Kerosine Oil Engine received from Loni.

Investigation of suitable pumping sites for raising fodder in time of Famine is one of my principle touring duties and although the work is extensive and involves much heavy travelling, about 50 sites have been visited during the year under report.

There were several calls for repairs and erections of bore hole pumps and nine works at Kedgaon, Bankapur, Broach, Haveri, Uran, Chinchwad, Yerawda, Poona and Ranebennur were attended to.

There has been no call for permanent erection of pumping machinery from agriculturists owing to prohibitive cost of machinery.

PRIME MOVERS.

The gas engine is probably the most promising engine of the future and if charcoal could be obtained for Rs. 20 per ton the cost of fuel per b.h.p. per hour could be reduced to about 2 pies, or, in other words charcoal at Rs. 20 per ton would reduce the cost of one Horse-Power for 12 hours a day throughout the year (3,720 hours) to Rs. 36-8-7. Whereas at Rs. 81 per ton the cost of one Horse Power throughout the year of 3,720 hours works out Rs. 156-15-0.

In this connection I am convinced that there is a big field for the production of charcoal from (otherwise) waste wood, and if the by-products were collected and utilised by the destructive distillation of wood the charcoal could in all probability be sold at the low rate of Rs. 20 per ton.

Power produced from charcoal at 2 pies per b.h.p. per hour for fuel alone can be compared with that obtained from another cheap source, that is, liquid fuel. An engine using 5 lb. of liquid fuel per b.h.p. per hour costs 2 pies per b.h.p. hour, when using imported oil costing Rs. 47 per ton. This is a little above the price in Bombay before the war, but the price now is nearly double that figure.

Waste wood from the forests is a source of power which should be taken up, so that small power users will not have to depend on imported oil which has to be railed long distances from seaports and fluctuates in price.

This is a problem that I have taken up and hope to have some useful figures in the near future.

WIZARD ENGINE.

This particular make represents a new design on the Diesel principle and dispenses with the usual stove for starting purposes, it also does away with Magneto and Carburetor and starts up from cold on kerosine. It is simplicity itself and ought to meet a long-felt want in prime movers.

The most modern type of steam engines, using superheated steam, claims a distinct advantage over the other types of prime movers as regards running expenses, as the fuel consumption and the upkeep are reduced to a minimum. So far the superheater is confined to big units but it has also recently been introduced on smaller units. The most efficient and self-contained unit of this description is the "Locomobile". The superheater consists of a detachable flue and fire tubes, which is bolted to the shell in such a way that it can be withdrawn when required for cleaning purposes. It is tubular in shape and is placed in the smoke-box. The heat from the hot gases (which would otherwise be wasted) raises the temperature 150° F. to 200° F. above the temperature of saturation. The use of superheated steam in a steam engine avoids the losses caused by initial condensation. It does not leak so freely as saturated steam and the losses due to leakage of steam through valves, glands and piston are thereby considerably reduced, thus effecting a double gain over saturated steam. The engine is generally compound and in the case of a portable engine is fixed on the top of the boiler. It is also fitted with balanced piston valves, feed water heater, condensor, air pump and injector in addition to the usual Feed Pump. From data supplied by the leading authorities it is very interesting to know that these units can compete favourably with any other class of prime movers especially when the prohibitive cost of fuel has to be considered. The following table of current rates for different types of prime movers is well worth considering :—

	Class of prime mover.	Consumption of fuel per b.h.p. per hour.	Cost of fuel per b.h.p. per hour	Rate of fuel.
			Rs. a. p.	
1.	Kerosine Oil Engine	½ pint.	0 1 0	Re. 1 per gallon
2.	Gas Engine using charcoal as fuel	1·25 lbs.	0 0 8·3	Rs. 81 per ton.
3.	Modern design of Portable Steam Engine ..	2·25	0 0 6·4	Rs. 33 per ton.
4.	Locomobile non-condensing	1·7	0 0 4·5	Do.
5.	Locomobile condensing	1·5	0 0 3·8	Do.
6.	Crude Oil Engine	5 lbs.	0 0 5·7	Rs. 150 per ton

Although the initial costs of Nos. 4 and 5 are comparatively greater, it is worth while considering whether such a prime mover will not fulfil the requirements of the agriculturist in this country.

BORING.

During the year under report the work of this branch has not progressed much especially in North Gujarat and Thana due to the fact that the number of enquiries fell off owing to good rainfall and all the Local Board machines which were previously worked by this Department for the last 6 or 7 years being returned. Two of these machines were most efficient and their return to the Local Boards naturally affected the progress of my own work. Moreover, the Calyx power machine met with unexpected mechanical troubles. The engine ordered for this machine was received with one flywheel broken and a new one could not be made without special preparations. Two works were held up due to accidents, and one machine has been lent to Development Department. This leaves me with only two machines working in Thana District.

LIST OF MACHINES RETURNED TO LOCAL BOARDS.

Taluka Local Board, Ranebennur.	District Dharwar ..	1	Musto Patent Boring machine.
Taluka Local Board, Madha ..	District Sholapur ..	1	Do.
District Local Board, Kaira ..	District Kaira ..	1	Calyx hand.
Do. ..	Do. ..	1	Cyclone Power machine.

There is a demand for the loan of boring machines from private bodies and Agricultural Societies. This year the Department has made an attempt to supply trained men and give necessary advice to Local Boards and other owners of boring machines with a view to enable them to conduct their own boring operations successfully. During the year under report the following help has been given.

1.—TALUKA LOCAL BOARD, KOD.

A mechanic was lent for three months and he has bored four holes and provided the public of Hirekerur with drinking water.

2.—AGRICULTURAL ASSOCIATION, ATHNI.

A mechanic to work the power boring machine purchased by the Association.

3.—KIRLOSKAR BROTHERS.

A mechanic to work the machine at Kirloskarwadi. This man has already made some bores successfully.

4.—SHELARWADI, DEVIDAS GULABDAS.

A mechanic was sent to show the method of erection and working, etc.

5.—SARASWAT HOUSE BUILDING SOCIETY, DHARWAR.

Advice in connection with the working of the machine.

From the above it will be seen that there is a demand from the people and that the work of this branch is appreciated.

During the year under report the work done in Bijapur District is worth mentioning as each work at Karlkop was undertaken with an ordinary tripod, *i.e.*, a device introduced by the Department in 1918 to undertake shallow works only, to cope with the increased demand in the absence of sufficient number of boring machines. The question of having these devices modified to suit the conditions is under contemplation with a view to replace the present Musto's hand machines where bores of less than 100 feet are sufficient to tap water. All hand power machines will be converted into Power units when funds permit with a view to cope with a greater number of enquiries.

Necessary statements regarding particulars of bores, etc., are enclosed in Schedule Nos. 1 and 2.

MECHANICAL CULTIVATION.

We have worked a Steam Ploughing Set for some years, to deal with deep rooted weeds such as Harali and Kunda and our experience shows that not only does it eradicate the grass but also produces a better crop, and fields that were infested with weeds are now producing valuable crops, fields which hitherto had only one use, grazing. There is great scope for this class of work, especially in the Southern Maratha Country, and the time has arrived for private agencies to operate in this direction.

It was estimated that at the time of purchasing this tackle there were, 500,000 acres of land in the Dharwar District alone, infested with Harali and although we have had the ploughing tackle in operation since 1913 we have not been able to complete even one Taluka.

Another aspect of Mechanical Cultivation is the tractor and at the moment there is no branch of Agricultural Engineering so completely under a cloud as is the one of tractor. Stories are in circulation that tractors are " passing out, " that they are illsuited to the country, "Mechanically unsound", not ryots machines and so on 'ad infinitum'. It is imperative that these injurious though not necessarily malicious tales should be countered. Against the foregoing, I maintain that the tractor is likely to be a most potent factor in reducing the costs of cultivation. But to prove such a claim it will probably be said the task will be of a most exacting character. Such is not the case however and although I have not been able to experiment extensively I am convinced that there is a future for this class of labour saving device even in this country, but they must have intelligent handling and herein lies the great drawback at the moment and training schools will have to be established to meet the demand. We have tested the following, *viz.*, Wyles Fowler 8 H.P. Petrol Combined set, Mogal 8-16 H.P. single cylinder, Cletrac 12-20 H.P. four cylinder, J. T. 17-35 H.P. four cylinder, Austin Fordson 20 H. P. four cylinder, Case 15-27 H. P. four cylinder, and the Sanderson 30 H.P. two cylinder. The Mogal, Sanderson, Case and Austin are of the four wheeled type and the Cletrac and J.T. of the caterpillar type.

The Wyles Fowler is a combined set, that is to say a Tractor and Plough built up in one unit. Both this and the Mogal being made with only one cylinder are very much out of date.

I would offer the following advice to every prospective buyer of a tractor :—

(1) Choose the tractor with a four cylinder, valve-in-head, motor-designed, to stand the severe service a tractor motor is subjected to. It should burn Kerosine economically, it should continuously develop its full rated horse-power on fuel without overheating.
(2) Choose a tractor that can develop a liberal reserve in excess of its rated H. P.
(3) Choose the tractor with all cut steel spur gears, the simplest type of transmission, and assurance for durability.
(4) Choose the tractor that has all vital working parts enclosed in dust-proof oil-tight housings.
(5) Choose the tractor that provides accessibility.
(6) Choose the tractor that has a high grade, high tension, dust and water-proof magneto requiring no batteries.
(7) Choose the tractor that is handy for all draw-bar and belt-work.
(8) Choose the tractor built by a concern whose reputation is known to be excellent and with sufficient financial responsibility to make its guarantee worth something.

The above advice and unbiased opinion are worth consideration when a tractor is contemplated.

Our tractor trials are enumerated in Schedule A.

CANE CRUSHING.

There has been practically no enquiry in this connection probably owing to the prohibitive cost of machinery. One combined cane crushing plant consisting of 6·5 B.H.P. Blackstone Engine and a 44 Chattanooga Crusher, both mounted on a girder frame and driven direct by means of flexible couplings, was kept in charge of the Deputy Director of Agriculture, S. D, Dharwar, and was demonstrated at Kittur and Chikodi, etc.

The Steam Engine at Manjari broke down at the eleventh hour when tons of over-ripe cane had to be crushed. Efforts were made to put the engine in order but as it was a big job requiring longer time owing to the renewal of some important parts, a 12 N.H.P. Portable Steam Engine from the Workshops had to be hauled to Manjari to work the crusher and by so doing, prevented a great loss to Government.

I am unable to say much about the Karajgi Fodder Bruising and Baling Plant as the machinery is being erected. The work was delayed owing to the late acquisition of the land.

ACTIVITIES IN SIND.

Pumping.

There were very few inquiries in this connection owing to prohibitive cost of machinery and want of trained mechanical labour. The landlords therefore always prefer water lifts worked by bullock power and the most appreciated ones are the Dutch-wheel, the Archimedian Screw and the Persian wheel, all worked by animal power.

DEPARTMENTAL WORK.

A new 10·5 B.H.P. Hornsby Oil Engine has been fixed with a 5" Ruston Centrifugal Pump for pumping out water from the Ghar canal to the fields in the Larkhana Government Farm in addition to the 6·5 B.H.P. Plant used for pumping water from the "Alro" canal :—

(*a*) About 40 acres of land have been ploughed this year at the Jakobabad Wheat Farm with the " Cletrac " tractor and about 8 acres were sown with a power seed-drill. It is proposed to use the tractor during the off-season to work a

thrashing machine, also such implements as Chaff cutters, and Winnowers through a countershaft and the result will be notified in the next report.

(*b*) Trials were taken on the Rajah Wheat Reaper and the 24" Improved Wheat Thrashing Machine. The former has been found most effective on a crop 3 feet high after increasing the diameter of the Cornside wheel. It is however not so satisfactory on a higher stalk.

The latter has worked most satisfactorily at the Larkhana Farm. The outturn is about 5 to 6 maunds per hour with a crushing percentage of 4 to 4½ per cent. A grading apparatus, which is fitted to the machine was also tried with great success. This appliance divides the grain into two sorts, one of pure good grain and the other of inferior or crushed grain. The ratio of good grain to inferior stuff is 9 to 1.

(*c*) It is 13 years since the Steam Pumping Plant at Sukkur Farm was installed and it is high time this had a thorough overhaul. The working expenses in its present state are very high and a general overhaul is absolutely essential.

GENERAL.

During the year under report the work of this section of the Department has been conducted on the lines laid down in Bulletin on Agricultural Engineering in the Bombay Presidency published in 1915, but there are new lines which owing to the executive work in the district and the ever increasing routine work in the office cannot be investigated and I shall be glad when the purely managerial work is transferred to the Teritorial Officers.

There is a great field for investigation in the various sections of my work. In pumping alone there is still a lot to do before we can decide definitely for the cultivator which is the right type of water raising device for his particular needs. I am flooded with requests from firms and inventors generally to test their particular device and give an official report on its capabilities. One cannot do justice to this work unless unnecessary routine work and pure management is given to the local officers.

I have before me between 30 to 40 different devices for raising water and it requires personal attention and careful tests before any satisfactory results can be obtained and this is impossible when an expert is swamped with administrative work which other men can do . There is a general cry for help from the various districts to improve and modify implements and perhaps in no branch of Agricultural Engineering is it so necessary for an expert and his staff to investigate and give the public the result of their investigation as in this particular one.

Then again, take Boring Machines. There is a great demand for something simple and effective and its quite possible that some substitute for the expensive casing pipes may be found; but this requires the whole time of an expert if any good is to be effected. I believe there is some simple method of mechanical cultivation than the standard outfits we are at present testing. In any case the standard outfits can be modified to suit our conditions and attempts have been made to do this but progress is slow owing to the many unnecessary duties my office has to perform. I, therefore welcome the proposed transfer of all administrative control to the Deputy Directors of Agriculture.

During the year under report I have had 115 enquiries on technical matters alone and to give justice to this particular work it is necessary to devote our whole time to technical matters.

I have an expensive experimental well fitted up for testing and there are many cultivators anxious to see the various lifts at work, but only a little of my time can be devoted to the testing and running at present. Under the new scheme however a great change will be possible and the relative efficiencies of the lifts can be worked out properly.

The high cost of machinery has affected the demand for labour saving devices in one direction, but conditions are becoming more normal and I anticipate a great rush for agricultural Machinery.

W. M. SCHUTTE,
Agricultural Engineer, B. P.,
Poona.

Abstract of work done.

Serial Number.	Particulars.	Northern Division.	Central Division.	Southern Division.	Sind.	Total.
1	Bores made	58	35	35	3	131
2	Broes successful	42	15	20	1	78
3	Broes unsuccessful	7	3	7	1	18
4	Broes abandoned at the request of the owner	3	5	6	....	14
5	Broes, incomplete	6	10	2	1	19
6	Total depth bored	3,689′0″	2,020′8″	2,066′7″	346′0″	8,122′3″
7	Percentage of success	85·42	83·3	74·0	50·	81·2
8	Number of gallons tapped per hour	1,34,610	20,020	7,910	1,500	1,64,040
9	Number of agreements registered ..	41	59	60	....	160
10	Average number of working days for each bore	17·1	13·0	17·0	....	....
11	Number of accidents	10	12	19	....	41
12	Accidents Removed	8	12	16	....	36
13	Average number of feet bored in one day	3′-8″	4′-4″	3′-4″	....	....

W. M. SCHUTTE,
Agricultural Engineer, B. P.,
Poona.

Statement showing the details of Bores undertaken during the year 1921-22 in the Presidency.

Serial Number.	Name of work or the name of the land-owner.	Name of Taluka.	Name of Village.	Diameter of Bore.	Depth of Boring.	Water before boring in gallons per hour.	Water after boring in gallons per hour.	Increase of water in gallons per hour.	Departmental Charges.	Labour Charges.	Total Cost.	Cost per foot.	Purpose of Boring.	Result and remark.
	District Kaira.			Inches.	Ft. in.				Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.		
1	Patel Chatoorbhai Motibhai ..	Anand ..	Karamsad ..	4	141 0	2,000	8,000	6,000	748 1 1	88 14 0	836 15 1	5 15 0	Agricultural ..	Successful.
2	Patel Desaibhai Kalidas ..	Borsad ..	Kantharia ..	4	46 0	1,000	4,000	3,000	232 15 2	78 0 0	310 15 2	6 3 8	,, ..	,,
3	Shah Chunilal Mangaldas ..	Nadiad ..	Dumsal ..	4	55 0	5,000	9,000	4,000	267 13 4	144 8 0	412 5 4	7 7 11	,, ..	,,
4	Majamandar Govindbhai Sarbhai.	Borsad ..	Dewalpura ..	3	87 0	3,000	8,000	5,000	205 12 0	143 4 0	349 0 0	4 0 2	,, ..	,,
5	Gosai Jiwanpuri Hardeopuri ..	Anand ..	Navali ..	4" reduced to 2½"	134 0	2,000	8,000	6,000	234 6 1	114 10 0	349 0 1	7 1 4	,, ..	,,
6	Patel Dayabhai Javerbhai ..	Nadiad ..	Manjipura ..	4	50 0	2,000	6,000	4,000	242 10 7	49 8 0	292 2 7	5 13 6	,, ..	,,
7	Varajbhai Jasbhar Patel ..	Borsad ..	Lakhadpura ..	3	86 0	1,000	7,000	6,000	199 5 8	172 2 0	371 7 8	4 5 1	,, ..	,,
8	Mathoor Bhaiji ..	Anand ..	Lalpur Tarnal ..	3	72 0	1,000	3,000	2,000	169 11 0	101 5 0	271 0 0	3 12 3	,, ..	,,
9	Patel Mangalbhai Parbhudas ..	Matar ..	Radhoo ..	3	20 0	....	..	..	..	..	..	..	,, ..	Failure.
10	Parman Hema Ragha ..	Anand ..	Samarkha ..	3	52 0	1,000	4,000	3,000	122 15 9	36 0 0	158 15 9	3 0 11	,, ..	Successful.
11	Maganbhai Parbhudas ..	Matar ..	Radhoo ..	3	5 0	..	..	..	..	..	..	..	,, ..	Abandoned at owners' request.
12	Shivbhai Hirjibhai ..	Nadiad ..	Narsanda ..	3	145 0	1,000	3,000	2,000	313 14 11	214 4 0	528 2 11	3 10 3	,, ..	Successful.
13	Patel Mathoorbhai Lalloobhai ..	Anand ..	Samarkha ..	3	40 0	1,000	5,000	4,000	92 15 9	15 0 0	107 15 9	2 11 2	,, ..	,,
14	Patel Nathabhai Dwarkadas ..	Borsad ..	Palej ..	3	120 0	500	1,500	1,000	257 15 7	135 6 0	393 5 7	3 4 1	,, ..	Successful.
15	Gosai Naranwan Dolatwan ..	Anand ..	Samarkha ..	2½	60 0	500	1500	1,000	155 3 2	39 0 0	194 3 2	3 3 9	,, ..	,,
16	Pagi Chuntha Naran ..	Mehmedabad ..	Dewabi bansole ..	3	120 0	..	..	..	..	..	..	..	,, ..	Failure.
17	Nathabhai Shanabhai ..	Anand ..	Samarkha ..	3	52 0	1,000	7,000	6,000	126 9 3	25 0 0	151 9 3	2 14 0	,, ..	Successful.
18	Inamdar Umedbhai Jaybhai ..	,, ..	Valsan ..	3	80 0	250	3,250	3,000	188 6 9	134 10 0	323 0 9	4 7 4	,, ..	,,
19	Mangalbhai Shiwabhai ..	Nadiad ..	Mehmadapura ..	4	53 0	1,000	3,000	2,000	263 0 0	25 0 0	288 0 0	5 6 11	,, ..	,,
20	Patel Lallubhai Naranbhai ..	Borsad ..	Pomol ..	4	60 0	..	..	..	..	..	..	..	,, ..	Failure.
21	Mangalbhai Shiwabhai ..	Nadiad ..	Mehmadapura ..	4	88 0	3,000	7,000	4,000	477 12 1	70 0 0	547 12 1	6 3 7	,, ..	Successful.
22	Patel Ambalal Motibhai ..	Borsad ..	Pandoli ..	3	33 0	2,000	3,000	1,000	92 0 11	50 4 0	142 4 11	4 5 0	,, ..	,,
23	Ambalal Dhaneshwar ..	Thasra ..	Dakor ..	3	15 6	250	3,250	3,000	64 13 5	30 0 0	94 13 5	6 13 5	,, ..	,,
24	Patel Girharbhai Lallubhai ..	Borsad ..	Pandoli ..	3	38 0	1,000	4,000	3,000	95 3 2	37 11 0	132 14 2	3 7 11	,, ..	,,
25	Jaitabhai Gadbadbhai ..	,, ..	,, ..	3	31 0	2,000	7,000	5,000	80 6 3	33 12 0	114 2 3	3 10 11	,, ..	,,
26	Motibhai Bhawanbhai ..	,, ..	, ..	3	71 0	1,000	5,000	4,000	163 13 8	92 2 0	255 15 8	3 9 8	,, ..	,,

27	Mahant Baldeodas Kaushalyadas.	Thasra ..	Dakor ..	3	19 0	..	..	..	....	....	....	....	„ ..	Incomplete. To be resumed.
28	Mahant Gordhandas Madhavdas ..	Borsad ..	Borsad ..	3	75 0	3,000	9,000	6,000	35 12 4	45 0 0	80 12 4	1 1 3	„ ..	Successful.
29	Patel Motibhai Valdas ..	Borsad ..	Pandoli ..	3	37 0	1,000	6,000	5,000	88 3 4	19 11 0	107 14 4	2 14 8	Agricultural ..	Successful.
30	Dadabhai Lallubhai ..	„	„ ..	3	72 0	500	5,500	5,000	163 0 0	69 4 9	232 4 9	3 3 7	„ ..	„
31	Manosbhai Hirabhai ..	„ ..	Borsad ..	3	84 0	..	..	..	....	....	....	....	„ ..	Failure.
32	Ishwarbhai Bhulabhai ..	Nadiad ..	Uttarsanda ..	4	74 0	..	..	..	....	....	....	....	„ ..	Abandoned at well-owners' request.
33	Saikh Mathoor Badhar ..	Nadiad ..	Nadiad ..	3	117 0	2,000	4,000	2,000	259 3 6	300 0 0	559 3 6	4 12 6	„ ..	Successful.
34	Javerbhai Mahijibhai ..	Borsad ..	Singlas ..	3	162 0	500	1,500	1,000	331 5 7	135 0 5	506 5 7	3 2 1	„ ..	„
35	Patel Girdharbhai Narsibhai ..	„ ..	Jesarva ..	3	128 0	..	..	..	....	....	....	....	„ ..	Failure.
36	Motibhai Mithabhai ..	„ ..	Ras ..	3	117 0	..	..	..	....	....	....	....	„ ..	„
37	Chokshi Jethalal Nathabhai ..	Nadiad ..	Nadiad ..	3	92 0	2,500	750	500	182 11 5	227 12 0	410 7 5	4 7 5	„ ..	Successful.
38	Hirabhai Narothamdas ..	Matar ..	Vasnav ..	3	166 0	1,000	5,000	4,000	371 7 10	250 0 0	621 7 10	3 11 2	„ ..	„
	District Ahmedabad.													
39	Waghela Shivsing Kakabhai	Sanand ..	Khoda ..	3	82 0	500	4,500	4,000	149 4 9	57 0 0	206 4 9	2 8 3	„ ..	„
40	Ahmedabad Advance Mill ..	Ahmedabad ..	Ahmedabad ..	4	110 0	1,000	3,000	2,000	617 12 1	250 0 0	867 12 1	7 14 3	Drinking ..	„
41	Vaghela Jethibhai Jalamsing ..	Sanand ..	Khoda ..	3	81 0	500	2,500	2,000	162 5 3	85 8 0	247 13 3	3 0 1	Agricultural ..	„
42	Ahmedabad Sarangpur Mill ..	Ahmedabad ..	Ahmedabad ..	4	113 0	Surface.		500	551 11 7	350 0 0	901 11 7	7 15 8	Drinking ..	„
43	Vaghela Varsibhai Jiwabhai ..	Sanand ..	Khoda ..	3	76 0	3,000	5,000	2,000	192 0 6	92 0 0	284 0 6	3 11 10	Agricultural ..	Successful.
44	Bhikaji Dinshavji Patel ..	S. Dashakroshoi ..	Shahvadi ..	3	46 0	500	1,500	1,000	128 2 2	75 0 0	203 2 2	4 6 8	„ ..	„
45	Mr. R. K. Kanga, Constructing Engineer Kalico Mills Ahmedabad	S. Dashakroshoi ..	Chimanpura ..	4	161 0	..	..	..	....	....	....	....	Drinking ..	Incomplete. To be resumed.
46	„ Ambalal Narandas Mali ..	„ ..	Madalpur ..	4	137 0	6,000	12,000	6,000	651 11 5	117 0 0	768 11 5	6 9 1	Agricultural ..	Successful.
47	„ Ashabhai Chatoorbhai ..	„ ..	Kubadthal ..	4	126 0	..	..	..	....	....	....	....	„ ..	Incomplete. To be resumed.
48	„ Kalidas Dungarsha ..	Sanand ..	Shihavada ..	3	105 0	500	10,500	10,000	209 3 4	120 0 0	329 3 4	3 2 2	„ ..	Successful.
49	„ Ambalal Naraindas Mali ..	S. Dashakroshi ..	Madalpur ..	3	72 0	..	..	..	....	....	....	....	„ ..	Incomplete. To be resumed.
50	„ Amritlal Kameshwar ..	Sanand ..	Khoda ..	3	225 0	..	..	..	....	....	....	....	„ ..	Failure.
51	„ Patel Chotalal Vaghjibhai ..	S. Daskhakroshi ..	Kubadthal ..	3	113 0	500	2,500	2,000	287 14 7	250 0 0	537 14 7	4 12 2	„ ..	Successful.
	District Panch Mahals.													
52	Inamdar Keshavlal Girdharlal ..	Kalol ..	Khandoli ..	4	44 0	500	1,000	500	44 8 3	40 0 0	84 8 3	1 14 9	„ ..	„
53	Haji Isha Sadik Sadwa ..	Godhara ..	Konja ..	4	41 6	..	..	..	....	....	....	....	„ ..	Abandoned at the request of the owners.
54	Vernacular Agricultural School ..	Godhara ..	Godhara ..	4	128 0	450	810	360	....	not known.	....	....	„ ..	Successful.

Serial Number.	Name of work or the name of the land-owner.	Name of Taluka.	Name of Village.	Diameter of Bore.	Depth of Boring.	Water before boring in gallons per hour.	Water after boring in gallons per hour.	Increase of water in gallons per hour.	Departmental Charges.	Labour Charges.	Total Cost.	Cost per foot.	Purpose of Boring.	Result and remark.
	District Broach.			Inches.	ft. in.				Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.		
55	Mr. Khudabux Nasarwanji ..	Ankleshwar ..	Ankleshwar ..	4" & 2½"	24 0	..	..	..	....	....	....	....	Agricultural ..	Incomplete. To be resumed.
56	Mansukhalal Parsottam ..	Jambusar ..	Vedach ..	2½	28 0	..	..	..	....	....	....	....	,, ..	Incomplete. To be resumed.
57	Vyas Shivshankar Jeyashakar ..	,, ..	Kareli ..	3	78 0	3,000	5,000	2,000	179 2 6	75 0 0	254 2 6	3 4 1	,, ..	Successful.
58	Mr. Chotalal Ghelabhai ..	Ankleshwar ..	Ankleshwar ..	4" & 2½"	40 0	1,000	1,750	750	224 8 7	95 0 0	319 8 7	7 15 10	,, ..	,,
	District Surat.													
59	Mr. Ardesar Jalbhai Dhanbhoora,	Balsad ..	Kapri ..	3	140 0	300	1,500	1,200	209 5 2	180 0 0	389 5 2	2 12 3	,, ..	,,
60	Mr. R. N. Agate ..	Pardi ..	Lawacha ..	6	134 0	Surface bore		2,000	303 12 2	38 0 0	341 12 2	2 8 9	,, ..	,,
61	Mr. R. D. Desai ..	Chikhali ..	Chikhali ..	3	29 0	..	..	..	....	....	....	....	,, ..	Abandoned at the request of the owner.
62	Mr. R. N. Agate ..	Pardi ..	Lawacha ..	6	71 0	1,000	2,500	1,500	72 13 9	21 0 0	93 13 9	1 5 1	,, ..	Successful.
63	Mr. R. N. Agate ..	,, ..	,, ..	6	73 6	700	6,000	5,300	74 1 7	10 8 0	84 9 7	1 2 6	,, ..	,,
64	Mr. Giwan Dayal ..	Balsad ..	Kapri ..	3	160 0	..	..	..	....	....	....	....	....	Abandoned at the request of the owner.
65	Mr. Ranchodji Vasanjee ..	,, ..	Bhoeli ..	3	34 0	..	..	..	....	....	....	....	Agricultural ..	Incomplete. To be resumed.
	District Thana.													
66	Mr. M. G. Marathe ..	Umbargaon ..	Bardi ..	5	8 0	..	..	..	....	....	....	....	,, ..	Incomplete. To be resumed.
67	Mr. Pirojshah Dajibhai ..	,, ..	Malav ..	3	10 0	..	..	..	....	....	....	....	,, ..	,,
68	Mr. Jaganath Kisanlal ..	Salsette ..	Malad ..	3	150 0	..	..	..	....	....	....	....	Drinking ..	Failure.
69	Dr. M. T. Sathe ..	Mahim ..	Tarapur ..	3	18 0	50	300	250	62 12 10	52 8 0	115 4 10	6 6 5	Agricultural ..	Successful.
70	Mr. G. M. Pimputkar ..	Umbargaon ..	Umbargaon ..	3	29 0	1,000	6,000	5,000	49 4 11	28 0 0	75 4 11	2 9 5	,, ..	,,
71	Mr. Raichand Virchand ..	,, ..	Achari ..	3	91 0	480	750	270	61 13 6	78 5 0	140 1 6	1 8 7	,, ..	,,
72	Mr. Haridas Parmanand ..	,, ..	Umbergaon ..	3	54 0	50	2,000	1,950	55 11 2	85 0 0	150 8 2	2 12 7	,, ..	,,
73	Mr. M. G. Marathe ..	,, ..	Bardi ..	3	37 0	..	..	..	....	....	....	....	,, ..	Incomplete. To be resumed.
74	Mr. Y. H. Desai ..	Salsetti ..	Borivali ..	3	92 0	..	..	1,000	130 12 7	210 0 0	340 12 7	3 11 3	,, ..	Successful.
75	Mr. Mohanji P. Desai ..	Balsad ..	Balwada ..	3	18 0	..	..	..	....	....	....	....	,, ..	Incomplete. To be resumed.
76	Mr. Gulabdas D. Nawalakhi ..	Salsette ..	Borivli ..	3	125 0	..	..	..	....	....	....	....	Drinking ..	Failure.

77	Mr. Gulabdas D. Navalakhi ..	,, ..	,, ..	3	36 0	..	..	..	....	....	....	....	,, ..	Incomplete. To be resumed.
78	Saraswat Co-operative Society ..	Bandra ..	Santa Cruz ..	3	155 0	..	..	..	....	....	....	....	,, ..	Incomplete.
79	Mr. Hari S. Chapekar ..	Mahim ..	Palghar ..	3	5 0	..	..	..	....	....	....	....	Drinking ..	Abandoned at the request of owner.
	District Kolaba.													
80	Mr. K. M. Talyarkhan ..	Panawel ..	Panawel ..	3	120 0	..	..	..	....	....	....	....	Agricultural ..	Abandoned at the request of owner.
81	Mr. V. M. Govilkar ..	,, ..	Palaspe ..	3	41 0	..	..	..	....	....	....	....	,, ..	Abandoned at the request of owner.
82	Mr. K. V. Joshi ..	Karjat ..	Mandavna ..	3	14 5	..	..	..	....	....	....	....	,, ..	Abandoned at the request of owner.
83	Government Farm, Karjat ..	,, ..	Karjat ..	..	..	..	..	..	....	....	....	....	,, ..	Incomplete. To be resumed.
	District Nasik.													
84	Mr. K. M. Pawar ..	Malegaon ..	Malegaon ..	3	54 0	..	..	..	....	....	....	....	,, ..	Incomplete. To be resumed.
	District Khandesh.													
85	Mr. P. M. Bildikar ..	Pachora ..	Bildi ..	3	56 3			400	....	105 0 0	105 0 0	1 14 0	,, ..	Successful.
86	Mr. P. M. Bildikar ..	,, ..	,, ..	3	41 0	..	..	400	....	75 0 0	75 0 0	1 13 3	,, ..	,,
87	Mr. J. S. Gagu ..	Erandol ..	Erandol ..	3	..	..	..	..	....	....	....	....	,, ..	Incomplete. To be resumed.
	District Nagar.													
88	President, Municipality, Kharda ..	Jamkhed ..	Kharda ..	3	27 6	..	..	..	....	....	....	....	Drinking ..	Failure.
	District Poona.													
89	Mr. Abdulbhai Husenalli ..	Haveli ..	Yeravda ..	3	50 0	..	..	..	....	....	....	....	,, ..	,,
90	Mr. Abdulbhai Husenalli ..	,, ..	,, ..	3	52 0	Surface.		250	....	99 0 0	99 0 0	1 14 5	,, ..	Successful.
91	Ebrahim & Co. ..	,, ..	Poona ..	3	33 0	..	..	250	30 10 9	54 0 0	84 10 9	2 9 1	,, ..	,,
92	Agricultural School ..	,, ..	Loni Kalbhor ..	3	95 0	Surface.		..	....	Not known.	....	....	,, ..	,,
93	Mr. S. P. Jadhav ..	,, ..	Poona ..	3	40 0	Surface.		250	....	Not known.	....	....	,, ..	,,
	District Dharwar.													
94	Deputy Director of Agriculture, Dharwar.	Gadag ..	Gadag ..	3	85 0	Surface.		240	72 10 5	214 12 0	287 6 5	3 6 1	Agricultural ..	
95	Mr. G. S. Yelmeli ..	,, ..	,, ..	3	72 0	Surface.		240	79 0 4	90 4 0	169 4 4	2 5 7	Drinking ..	
96	Messrs. Kale Brothers ..	Hubli ..	Hubli ..	3	62 0	Surface.		240	105 1 3	31 8 0	136 9 3	2 3 3	,, ..	,,
97	Mr. Shindgi ..	,, ..	,, ..	3	51 0	..	240	240	34 1 6	75 0 0	109 1 6	2 2 3	,, ..	,,
98	Dewargudda Municipality	Ranebennur ..	Dewargudda ..	3	117 0	..	250	250	87 9 8	230 0 0	317 9 8	2 11 5	,, ..	,,

Serial Number.	Name of work or the name of the land-owner.	Name of Taluka.	Name of Village.	Diameter of Bore.	Depth of Boring.	Water before boring in gallons per hour.	Water after boring in gallons per hour.	Increase of water in gallons per hour.	Departmental charges.	Labour charges.	Total Cost.	Cost per foot.	Purpose of Boring.	Result and remarks.
	District Dharwar—contd.			Inches.	Ft. in.				Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.		
99	Agricultural School ..	Haveri ..	Devihosur ..	3	66 0	..	800	800	41 13 7	36 12 0	78 9 7	1 3 1	Agricultural ..	Successful.
100	„ „ ..	„ ..	„ ..	3	15 0	..	..	..	....	....	....	....	Drinking ..	Abandoned at the request of owner.
101	„ „ ..	„ ..	„ ..	3	67 0	..	250	250	64 9 0	45 4 0	109 13 0	1 10 3	Agricultural ..	Successful.
102	President, T. L. B, Kod ..	Kod ..	Hirekerur ..	3	45 0	..	2,000	2,000	....	Not known.	....	....	Drinking ..	Bores taken on behalf on T. L. B.
103	„ „ ..	„ ..	„ ..	3	68 0	..	500	500	....	....	....	....	„ ..	„
104	„ „ ..	„ ..	„ ..	3	93 0	..	500	500	....	....	....	....	„ ..	„
105	„ „ ..	„ ..	Balambud ..	3	25 0	..	500	500	....	....	....	....	„ ..	„
	District Bijapur.													
106	Mr. Gopal Narayan Patel ..	Badami ..	Karlkop ..	3	35 0	Surface.		240	2 12 2	5 0 0	7 12 2	0 3 7	Agricultural ..	Successful.
107	Mr.Gurunath Dattatraya Bankapur	„ ..	„ ..	3	35 0	„		240	2 12 2	5 0 0	7 12 2	0 3 7	„ ..	„
108	Mr. Irappa Bhimappa Gawdar ..	„ ..	„ ..	3	27 0	„		240	2 8 2	5 0 0	7 8 2	0 4 5	„ ..	„
109	Superintendent, Prison ..	Bijapur ..	Bijapur ..	3	97 0								„ ..	Failure. Test to be taken.
110	„ „ ..	„ ..	„ ..	3	44 0	..	..	250	....	Not known.	....	....	„ ..	Successful.
111	„ „ ..	„ ..	„ ..	3	18 0	..	..	250	....	Not known.	....	....	„ ..	Test to be taken.
112	Mr. N. R. Utagi ..	Indi ..	Anjutgi ..	3	50 0	..	..	..	....	....	....	....	„ ..	Abandoned at the request of owner.
	District Satara.													
113	President, D.L.B., Satara ..	Walva ..	Islampur ..	3	168 0	Surface.		240	141 0 7	432 12 0	573 12 7	3 6 8	Drinking ..	Successful.
114	Mr. Usafbhai Mohim ..	„ ..	„ ..	3	168 0	..	..	200	135 8 1	306 0 0	441 8 1	2 10 1	„ ..	„
115	„ „ ..	„ ..	„ ..	3	123 5	..	..	..	....	....	....	....	„ ..	Failure.
116	Khan Bahadoor D. B. Cooper ..	Satara ..	Satara ..	3	64 6	..	..	..	....	....	....	....	Agricultural ..	Failure.
117	„ „ ..	„ ..	„ ..	3	32 0	..	..	..	....	....	....	....	„ ..	„
118	„ „ ..	„ ..	„ ..	3	31 0	..	..	..	....	....	....	....	„ ..	„
119	„ „ ..	„ ..	„ ..	3	49 0	..	..	..	....	....	....	....	„ ..	„
120	Mr. A. M. Kuber ..	Man ..	Dahiwadi ..	4	141 6	..	..	..	....	....	....	....	„ ..	Incomplete. To be resumed.

	District Kanara.														
121	Mr. Govindrao Shethi ..	Honawar ..	Honawar	3	17 1	..	..	240	55 2 11	84 6 0	139 8 11	8 2 8	Agricultural ..	Successful.
122	Superintendent, Agrcl. Farm ..	Kumta ..	Kumta ..	3	15 0	..	..	..	....	....	....	....	,, ..	Abandoned at the request of owner.
123	,, ,, ..	,, ..	,, ..	3	34 1	..	..	..	....	....	....	....	,, ...	Incomplete. To be resumed.
	District Ratnagiri.													
124	Mr. A. L. Patne ..	Khed ..	Khed ..	3	135 0	..	..	..	....	....	....	....	,, ..	Failure.
125	Manager or Superintendent, Farm.	Ratnagiri ..	Hatkhamba ..	3	132 0	..	..	..	....	....	....	....	,, ..	Abandoned at the request of owner.
	District Belgaum.													
126	Campaign Work ..	Gokak ..	Kulgod ..	4	107 0	..	..	..	....	....	....	....	,, ..	Abandoned for want of funds.
	District Sholapur.													
127	President, D. L. B., Sholapur ..	Sholapur ..	Arjunsonda ..	3	92 0	..	..	..	....	....	....	....	,, ..	Abandoned at the request of owner.
128	,, ,, Madha ..	Madha ..	Bembla ..	3	73 6	..	..	250	....	Not known.	....	....	Drinking ..	Successful.
129	Mirpurkhas Farm ..	Mirpurkhas	Mirpurkhas ..	4	185 0	..	..	..	....	....	....	....	Agricultural ..	Failure.
	District Larkhana.													
130	Larkana Farm ..	Larkana ..	Larkana ..	4	28 0	..	1,500	1,500	....	Not known.	....	....	,, ..	Successful.
131	,, ,, ..	,, ..	,, ..	4	133 0	..	..	..	....	....	....	....	,, ..	Incomplete. To be resumed.

W. M. SCHUTTE,
Agricultural Engineer, B. P.,
Poona.

Results of Tests on three Motor Ploughs worked at different places.

Date.	Name of Tractor.	Name and Type of Plough.	Kerosine.	Lubricating Oil.	Petrol.	Grease.	Area ploughed.	Depth.	Stoppages.	Actual working hours.	Water used for cooling.	Nature of Soil and Tracts.	Average cost per acre including driver's wages, etc., but excluding interest, repairs, etc.	Average cost per acre including interest, repairs depriciation, etc., restricting the use to ploughing only.	Remarks.
			G. Pt.	G.	Pt.	Lb.	Acre.	Inches.	Minutes.	H. M.	Gallons.		Rs. a. p.	Rs. a. p.	
13th April 1921 ..	J. T. Tractor 17·35 B. H. P.	3 Furrow Ranson's P. C. 28 Type without Coultar.	8-6	$\frac{1}{3}$	2	$\frac{1}{8}$	2-$\frac{1}{12}$	8"-10"	8	2-8	..	Agricultural College Farm. Fairly light cotton plant stubble wet on Top owing to Rain.	5 12 2	12 9 8	8 minutes stoppage owing to broken coupling of shuckle.
13th April 1921 ..	" Cletrac " 12·20 B. H. P.	3 Furrow No. 273 Oliver plough fitted with 231 D. S. 8 Mould boards.	5-8	$\frac{1}{8}$	2	$\frac{1}{8}$	2	8	11	2-58	..	Do. ..	3 8 6	8 4 7·5	Stoppage due to self lift, cord breaking and cleaning of shares.
							A.G.								
5th June 1922 ..	" Case " ..	Grand Detone 3 Furrow self lift plough.	16-0	$\frac{1}{2}$	1	$\frac{1}{2}$	2-20	9	..	8-0	64				
									Hours.						
6th June 1922 ..	Do. ..	Do. ..	16-0	$\frac{1}{2}$	1	$\frac{1}{2}$	2-7$\frac{1}{2}$	9	1	7-0	80				Engine did not start quickly. Started late.
7th June 1922 ..	Do. ..	Do. ..	16-0	$\frac{1}{2}$	1	$\frac{1}{2}$	2-7$\frac{1}{2}$	9	1	7-0	80				
8th June 1922 ..	Do. ..	Do. ..	16-0	$\frac{1}{2}$	1	$\frac{1}{2}$	2-20	9	..	8-0	80	Heavy Black cotton soil full of kunda at Paldhi in East Khandesh.	6 13 2	11 3 2	
9th June 1922 ..	Do. ..	Do. ..	16-0	$\frac{1}{2}$	1	$\frac{1}{2}$	2-20	9	..	8-0	96				
10th June 1922 ..	Do. ..	Do. ..	16-0	$\frac{1}{2}$	1	$\frac{1}{2}$	2-20	9	..	8-0	96				
11th June 1922 ..	Do. ..	Do. ..	16-0	$\frac{1}{2}$	1	$\frac{1}{2}$	2-7$\frac{1}{2}$	9	1	7-0	96				Front axle of tractor was lost and the work had to be stopped. Work was stopped on account of rains.
12th June 1922 ..	Do. ..	Do. ..	8-0	$\frac{1}{2}$	1	$\frac{1}{2}$	0-37$\frac{1}{2}$	9	..	3-0	48				

W. M. SCHUTTE,
Agricultural Engineer, B. P.,
Poona.

APPENDIX P.

REPORT OF THE HORTICULTURAL SECTION FOR THE YEAR 1921-1922.

On August 1st, 1921, fruit improvement work in the Presidency and Horticultural teaching work in the Agricultural College were separated from the Establishment of the Economic Botanist to Government, Bombay, Poona, under the control of the Horticulturist to Government, Bombay, Poona.

The problems that demanded major attention of this newly created section of the Agricultural Department were submitted to the authorities under this Office No. 1-A of July 30th, 1921. This provisional programme was duly approved by the Director of Agriculture, Bombay, Poona. For want of adequate assistance and sufficient funds to conduct experimental work in all fields activities were confined to a few items only. At any rate one may feel confident to be able to record at this time substantial progress of the work as compared with the means at disposal.

STAFF OF THE HORTICULTURAL SECTION FOR 1921-1922.

Indian Agricultural Service.

1. Horticulturist to Government, Bombay Presidency, Poona, Indian Agricultural Service.

1. The District Horticultural Officer, Poona, Provincial Agricultural Service.

1. The Superintendent, Ganeshkhind Botanical Gardens, Kirkee, Senior Graduate Fieldman.

1. The Superintendent, Modi Bagh, Agricultural College, Poona, Junior Graduate Fieldman.

2. The Demonstrator in Horticulture, Junior Graduate Fieldman.

3. The Graduate Fieldman, G. B. Gardens, Kirkee, Junior Graduate Fieldman.

GRANTS AT THE DISPOSAL OF THE HORTICULTURIST TO GOVERNMENT FOR 1921-1922.

	Rs.
Office of the Horticulturist	2,000
Office of the District Horticultural Officer	1,000
Ganeshkhind Botanical Gardens, Kirkee	17,565
	5,000 to E. B.
Modi Bagh, Agricultural College, Poona	14,875
Laboratory	*Nil.*

The value to the Presidency of the extension of work to solve difficult horticultural problems of the Konkan tract, Southern Maratha Country, Gujarat and Sind cannot be questioned. The necessity of the extension of work is felt because want of sufficient experimental data under various climatic conditions is causing serious delay in the execution of advisory work. Such a delay although inevitable to maitain the good name for the Department is really a set back to the improvement of cultivation and development of fruit industries.

These tracts enclose an area of 85,635 square miles with 11,903,841 population. Conditions are so variable in different districts of the Presidency, that it is rather difficult to command the work successfully with such a scanty staff. It is keenly felt that the results acquired at one locality cannot be prescribed to the growers for immediate use in another. Considering the importance of the fruit improvement work, therefore, it is highly desired that liberal grants of funds may be appropriated to meet necessary requirements to promote fruit cultivation.

ACTIVITIES OF THE HORTICULTURAL SECTION.

Activities of the horticultural section are divided as follows :—

1. Investigational work.
2. Advisory work.
3. Teaching work.

INVESTIGATIONAL WORK.

At present more efforts are concentrated on research than other works. The College, Laboratory, the G. B. Gardens, Kirkee, and the Modi Bagh are jointly held responsible for the solution of difficult horticultural problems. These institutions are co-operating wonderfully to avoid duplication of efforts and to insure the best service to the grower.

The following items are under investigation :—

1. Laboratory :—

Fruit juices.

(*a*) Pomegranates.

(*b*) Lemons.

2. G. B. Gardens :—
   (*a*) Improvement of fruits by selection.
   (*b*) Root exposure.
   (*c*) Die-back of oranges.
3. Modi Bagh :—
   (*a*) Stocks.
   (*b*) Irrigation.
   (*c*) Improvement of vegetables.

POMEGRANATE JUICE.

Investigations to preserve Pomegranate Juice in both fresh and fermented condition were met with good success. Fresh juice is allowed to settle for 6 to 8 hours at a temperature of about 60° F. After most of the impurities settle down it is filtered. It is put into sterilized bottles and after heating at a temperature of 85° c. it is corked airtight and reheated at a temperature 80° c. to save from further spoilage in store. Bottles are stored below 80 F. Thus treated bottles are keeping in good condition for the last 9 months.

Color of the juice depends upon the quality of the fruit. Our local pomegranate gives shining red color. Kandhari pomegranate gives dark red color and Muskat gives pink light.

CHEMICAL COMPOSITIONS.

Name of pomegranate.	Juice. Per cent.	Sugar. Per cent.	Acid. Per cent.
Local	57·20	7·65	48·38
Kandhari	76·00	13·22	·78
Muskat	69·74	11·32	·27

The local pomegranate does not make tasteful beverage. Its juice when fermented is thin and flavourless. The white deposit collected on settling of the pomegranate juice consists of exclusively one type of yeast—S. *apiculats*.

The Kandhari pomegranate gives satisfaction in beverage preparations.

LEMON JUICE.

The Kagdi lemon juice is equally excellent in flavour, clear and rich in acid contents as foreign commercial juice of lemon. Fruit juice, after extraction is kept in cool temperature for two days. It is filtered clear and heated at 60° c. for about 30 minutes. Bottles are properly corked and stored in a cool place. We are keeping our bottles below 80 F. in good condition for the last 9 months. Slight sediment is noticed at the bottom.

Kagdi lemon grown in the Konkan tract, Southern Maratha Country and Sind are alike in acid contents and flavour. Sugar contents show difference.

As both of these juices could be economically handled by manual labour, so there are great opportunities for industrial development of this type in India. It is never doubted that extraction of lemon juice some day could be made a popular cottage industry. But at present its output is greatly limited. There are hardly more than 200 acres under lemon cultivation in the whole Presidency.

Pomegranate juice is delicate to handle. A consolidated concern alone can make profit.

PACKING IMPROVEMENT.

Oranges.—During the course of the last year's experimental despatches to long distances it is observed that safety of orange fruits is inversely proportional to the number of layers in a package under normal weather conditions. A single layer of two dozen Mosambis wrapped in a paper and packed in a wooden package travelled to Edinburgh in agreeable shape in the month of November 1921, without cold storage. Basket packing is inexpensive but serviceable for short distance only. For long distance, *viz.*, 1,000 miles baskets if piled one over the other show loss of fruit more than it would cost to substitute wooden material instead of straw. Loss is counted comparatively twice as much in loose skin than in tight skin. Loss is mostly due to the injuries caused by the fruit stock retained with the fruit. Rot starts if the skin is completely punctured. Thin strong rind with proportionally less moisture and oil resists partial bruises and fruits could be cleaned with brushes or something equivalent. Even the total forcible separation of stalk from the fruit does not do much damage. For long distances fruits may be packed before they are fully ripe. There is only slight loss in weight.

Bananas.—Whole bunches of Velchi bananas have been shipped to Massoorie and Mediterranean in good condition, when wrapped in thick brown paper and packed in Bamboo

baskets. To prevent foreign injuries and insure rough handling the lid and bottom of the basket should project two inches at least from the body. To hold the bunch firmly in the basket banana leaf rope may be fitted between the brown paper and the inner side of the basket. This packing is equally protective and durable as the card board or wooden material. Such a basket costs Re. 0-12-0. only.

GANESHKHIND BOTANICAL GARDENS, KIRKEE.

Improvement of fruits by selection.

Grapes.—Four years individual tree record shows the following result :—

1. Some vines bear high constantly.
2. Pandhri Sahebi bears seedless bunches casually.
3. Kali Sahebi has got the highest percentage of sugar, *i.e.*, 22·00 per cent., and Patwardhani lowest, *i.e.*, 11·00 per cent. ; others are as follows :—

Pandhari Sahebi	.. ..	18·09 per cent.
Kandhari	.. ..	19·70 „
Fhakadi	.. ..	16·40 „
Black Prince	.. ..	17·10 „
Bhokari	.. ..	18·60 „

4. Average yield of Bhokari for 1921 in the G. B. Gardens is as follows :—

	lbs.	ozs.	
Single stalk (Plants of different ages)	5	4	per plant.
Umbrella	27	13	„
Junnar	8	6	„
Kniffen	23	5	„

High yielding vines are being used as stocks and propagated to watch if low yielding kinds could be made to bear better than at present.

Selection work is extended to guavas, oranges and mangoes. No results in these crops could be available for two years more to come at least. But our stocks and scions in orange propagation in the nursery practice are all selected.

ROOT EXPOSURE.

The practice of root exposure of fruit trees is equivalent to :—

(*a*) Root pruning, (*b*) Aeration, (*c*) Manuring.

It is helpful on heavy soil and forcing climate conditions to get fruit in and out of season. In such a locality it is useful for intensive cultivation as well. Its influence on fruitbud formation in grapes is doubted. Experiment does not show any increase in bloom. Orange trees bloom abundantly after five—six weeks of exposure. Where root formation is retarded abscission at the base of the flower is immediately formed and the bloom drops. Such trees suffer immensely and in many cases lose vigour. Trees where brooms appear at the cut end of the roots bear well.

Roots which are cut straight make regular brooms. Oblique or irregular cuts produce scanty or no growth at all.

Root exposure could be substituted by deep cultivation where market problem is ignored. Deep cultivation cannot shift seasons to such an extent as root exposure does.

The effect of root exposure still remains to be observed on light soils of East Khandesh and Sind.

DIE-BACK OF ORANGE.

Die-back of Citrus fruits in this Presidency is observed to be due to the following facts :—

1. Inefficient root exposure and excessive manure.
2. Extreme draught and water logging conditions.
3. Extremely shallow soil where trees are only planted on rocks.
4. Fungal diseases like Diplodium.

The number of dying plantations is unusually great. Most of the losses in this line could be reduced if fruit growers were to consult the Department before planting their orchards. Our efforts to revive such plantations may not be looked with any bright results. At any rate wherever water logging conditions exist and trees are dying of excessive manure, we are applying trenches and renewal of clean soils as remedial measures. To save trees from dying on very shallow soils we are using excessive quantities of humus and for Diplodium and other fungal diseases causing die-back we are pruning and burning the deadwood. To what extent these operations are helpful to the growers, we will publish when the results will be available. At any rate the results are viewed optimistically.

In addition to these three main lines of investigational work the following valuable conclusions have been worked out in the Ganeshkhind Botanical Gardens, Kirkee :—

(*a*) The first year individual tree record of our guava collection shows that the crop shows considerable variations in foliage, yield, shape and seed character. Grafted trees in our collection are on the average better than the seedlings. To improve its quality some cheap method of propagation vegetative in nature, is a necessity. Side grafting, budding and cuttings give poor results. Of course layering, enarching and propagation by root buds are already well known. We are also busy to find out the best stock.

(*b*) Extensive experimental data is made available to show that Mangoes and Chiku plants could be sent to distant places—Aden, Burma, Northern India—in good condition. Facts with instructions to pack and receive are already compiled and submitted for publication.

(*c*) Top-working of mangoes :—

There is a growing demand for information on this subject. Our efforts to make this operation economical are still in progress. At present it costs about Rs. 40 per plant. Some growers seem to have appreciated this work. They are renewing their trees accordingly. The last Mango exhibition at Ratnagiri made a good impression upon the growers who are now anxious to learn this craft.

MODI BAGH.

Stock experiments.

The variations in yield of trees of the same variety in the same orchard planted at the same time and cultivated and treated as nearly alike as possible and common occurrence of rough and smooth or sour and sweet oranges on the same branch have caused us to investigate into this problem of selection of stock and scion in the Citrus propagation.

These variations we believe may be either due to :—

1. Variations inherent in the buds due to different heritage, or 2. To different kinds and characters of stocks used.

This problem is being studied by keeping careful records of individual tree production in our own orchards at G. B. Gardens.

We are making attempts to collect the different types of Jamburi to find out as to what extent these variations in the stock affect the quality and quantity of fruit borne by the scions.

Besides this we are running experiments with different sized nursery trees. The object is to secure uniform nuresery stock in order to render the trees in all plots as nearly equal in their growth as possible and thus reduce to a minimum the difference in size and yield of the plots due to individual tree variations. From our observations on the graded plants of citrus, we believe that the difference in size observed at the planting time continues years after year and will probably affect the yield proportionally.

In fact, this work is very slow and no definite results are expected till the controlled stocks bear fruit.

Irrigation.

We have tried basin, ring, flood and furrow irrigation systems up-till now from which we conclude that the furrow irrigation have given most satisfactoiy and economic results for the following reasons :—

(1) Furrows hold less water.

(2) In the case of young plants the furrows being opened quite close to the plants on either sides earth up the plants and the moisture is retained for a longer time than in the case of bed system or basin system where after irrigation the soil usually cracks and loses moisture to a very great extent.

(3) The feeder roots directly receive the water from the furrow which serves as a water and feeding trough.

(4) The water which was wasted in watering the roots other than the feeders and which mostly disappear in the crevices of our permanent basin or slip runs smoothly in the furrows which are freshly made each time and gives opportunity to the plants to utilise it to the fullest extent.

(5) The root collar is always kept free from the water in this system.

(6) This system offers easy and uniform harrowing and ploughing in the inter spaces without any extra manual labour which is required in the case of other systems.

This system seems to work well with our Citrus, Mangoes and guavas. In fact we have changed our practice after this system in most of our plots in the Ganeshkhind Botanical Gardens, Kirkee. To insure success the furrows should not be longer than 60 feet from the supply ditch. This system has not been found satisfactory on the slopy ground where water runs rapidly

without soaking the soil layers below. The use of basins seems to be helpful on clay shallow soils where trees are planted in pits.

The number of furrows on either sides of the grove depends upon the age of the trees, the space between the rows, the depth of the furrows, etc. Young trees are irrigated by one or two furrows and the bigger trees with more than two furrows on either side.

Our efforts are further concentrated to test the validity of this system separately in each fruit crop grown in this Presidency.

Vegetable Improvement.

The selection of tomatoes and potatoes is the main work under observation in this line.

Tomatoes.—The climate of Poona district may be regarded the most congenial for the cultivation of tomatoes. Our yield record shows :—

Kind of seedlings.	Area Sq. Ft.	Yield.	Yield calculated per acre in lbs.
Vigorous	11,200	2,687	10,460
Weak	11,154	3,046	11,895

where they are grown as inter crop.

We are selecting seeds from the various vines to watch the improvement in yield. Secondly, we are selecting acclimatised strain suitable for bottling purposes. Our selected seeds are under further trials.

Potatoes.—Potatoes raised from seeds are undergoing selection for the last two crops. Third selection is considered essential before results are announced. Our object is to acclimatise potatoes and ascertain if high bearing hills breed true. Crops raised from seeds show considerable variation in shape and colour of the tuber. The crop is not absolutely free from fungal diseases.

It is interesting to note that potatoes of marketable size have been grown from the seeds of the Flour snow ball during the Monsoon season in the Ganeshkhind Botanical Gardens, Kirkee.

DISTRICT WORK.

Considerable attention has been given to the advisory work in the Presidency. Number of enquiries regarding fruit cultivation are daily increasing. Lack of experimental data, absence of reliable stock and insufficient district help prevent us from extending our activities. At any rate we have successfully met fruit growers on spot to solve their difficulties in cultivation and in laying out new orchards.

To supply reliable stock to the fruit growers experimental nurseries have been started at Kolhar and Poona. These nurseries will be worked out by the Department for few years, after which the growers will maintain them as much for their own use. This may be regarded as a practical step to improve the nursery practice all over the Presidency.

In addition to this, areas infected with orchard pests are being noticed. To combat with the severe attacks of Aspidiotus and Aleurvides in our orange groves we are spraying heavily with fish oil rosin soap as we have not got means to fumigate them. Such results will be intimated to the authorities in a separate report as desired.

G. CHEEMA,
Horticulturist to Government, B. P.,
Poona.

APPENDIX Q.

WORK DONE BY THE INSPECTOR OF AGRICULTURAL SCHOOLS, POONA, DURING THE YEAR 1921-22.

I was in charge of the post of the Inspector of Agricultural Schools during the year under report.

All the 5 Agricultural Schools in the Presidency proper had sufficient number of students except the Lord Willingdon Agricultural School at Veshvi. The statement below shows the localities and number of students studying in each school :—

STATEMENT.

District.	Village and Taluka.	Number in 1st year.	Number in 2nd year.	Total number.	Remarks.
Poona	Loni / Haveli ..	23	23	46	
Thana	Jambhul / Kalyan ..	20	9	29	
Kolaba	Veshvi / Alibag ..	8	4	12	
Panch Mahals / Gujarat	Ambali / Godhra ..	14	17	31	
Dharwar	Devi-hosur / Dharwar ..	..	..	26	

The Lord Willingdon Agricultural School at Veshvi has been closed from June 1922. Thus there will be only four schools running now in the Presidency proper. The schools were regularly visited and during these visits attention of the teachers was drawn to make the course as practical and interesting as possible; this was demonstrated to the teachers by taking the classes both on farms and in class-rooms from time to time. More stress was laid on maintaining the school records of the farms, poultry, milch-cattle and boarding in proper form so that they may be useful to the teachers for their class work. The teachers were shown that the use of such records is more useful to them than dry notes from the books. The importance of these records in teaching was also brought to the notice of the Deputy Directors of Agriculture concerned who agreed and instructed the Head Masters to maintain the records and use them.

Out of the schools proposed last year none could be started during the year for want of funds. It was proposed to start an agricultural school at Niphad, District Nasik, in hired buildings, but this also was dropped for want of provision in budget for 1922-23.

As no funds were available for the new schools, the work proposed last year was not taken in hand except the scheme for an Agricultural School at Dhulia, in West Khandesh District. The District Agricultural Association has proposed to start an Agricultural School at Dhulia since there exist the following facilities :—

(1) Government Farm available for the use of the School.

(2) Technical School Buildings and Staff.

The District Local Board has offered a portion of their buildings for starting an Agricultural School and give the benefit of the staff in their workshop for teaching carpentry and smithy to the students of the Agricultural School. The question of this school was thoroughly discussed in a meeting presided by Dr. H. H. Mann, held at Dhulia on 25th May 1922 and it was settled to move the Government to sanction opening an Agricultural School at Dhulia in West Khandesh. The school is to be started if following conditions are fulfilled :—

(1) A part of the Technical School Buildings should be given for the Agricultural School.

(2) The staff of the institution should take the classes in carpentry and smithy of the Agricultural School.

(3) The boarding and lodging of the students be managed by local bodies and the local Funds obtained should be placed at their disposal for the purpose.

(4) Government Farm area and the available staff there be utilised for the school teaching work.

These were the main items that were agreed to by the members of the Association. They should be on Loni type except that the educational test, which should be vernacular 6th or 7th. The Director of Agriculture was requested to send the proposals to the Government on those lines. It is expected that the Government may sanction this school this year and if we get the sanction it probably will be started from October or November 1922.

At the request of Pachora Association some primary schools in the taluka were inspected and all other conditions were studied by discussing with the leading members of the Association. With due consideration of the problem it was proposed that instead of giving full Agricultural School to the Taluka it will be better if a beginning is made by introducing nature study with a view of giving agricultural tinge to the teaching in one or two full primary schools and find out from experience of these schools the real needs and taste of the people there. It was further proposed that one or two schools from this Taluka may be selected for the new scheme of 20 schools for agricultural training.

The question of introducing an Agricultural Education in 20 primary schools is also under consideration and it is expected the training of teachers will be taken in hand soon at Loni Agricultural School.

Besides these educational activities, I had to arrange a class for the District Propaganda Officers to explain the new propaganda scheme, to bring them in touch with the new investigations done by central Institution and give them up-to-date information of the work done and investigations by the Expert Staff at Poona. This class was arranged in the month of April 1922, with a programme of series of lectures and demonstrations, for 12 days. This attempt of bringing the men together and giving them the up-to-date information will prove very useful to all concerned, and it is hoped that it will form a part of the regular annual programme of the departmental work. A copy of the programme and report about the class is given in appendix No. I.

I had also to arrange and manage an Agricultural Show at Kalyan in consultation with the Deputy Director of Agriculture, Konkan Division, at the time of the sittings of the Maratha Educational Conference. All arrangements both of Farm and stall demonstration were arranged for the show, but it had to be closed at the request of the Managing Committee of the Conference owing to the announcement of the untimely death of H. H. the Maharaja of Kolhapur. The Farm and outdoor spraying demonstrations were stopped but the stalls were kept open for the public and those present took advantage of it; as a result we had some inquiries and requistions either for seeds or for fruit plants. Messrs. Macbeth Brothers and Kirloskar Brothers helped us by arranging a stall of their implements and our thanks are due to them.

The annual examinations of four schools, *viz.*, Loni, Jambhul, Veshvi and Godhra (Ambali), were conducted with the help of Messrs. Gadgil for Loni School, Hanmante for Jambhul and Veshvi and Mujmudar for Godhra.

K. M. PAWAR,
Inspector of Agricultural Schools.

APPENDIX I.

Accompaniment to the Annual Report of the Inspector of Agricultural Schools, Poona, for the year 1921-22.

Report of the propaganda class.

No. 419 of 1922.

POONA AGRICULTURAL COLLEGE.
Poona, dated 12th May 1922.

From—K. M. Pawar, Esquire, B.Ag., Acting Inspector of Agricultural Schools, Poona;

To—The Director of Agriculture, Bombay Presidency, Poona.

Sir,—I have the honour to submit herewith the report of the meeting of thepropaganda staff, arranged at the Agricultural College, Poona, from the 10th to 22nd of the last month, with a view of giving the recent results of investigations and the proposed methods of propaganda work.

Out of the selected officers Messrs. Tatake from S. C. D. and Angadi from the staff of the Deputy Director of Agriculture, Animal Breeding, did not come as they had urgent work to attend, in their divisions, and of those who attended the class Mr. R. B. Nimbalkar went on leave from the 18th of April 1922.

All the lectures were taken as shown in the programme, the only change being that Messrs. C. G. Paranjape, Personal Assistant to the Agricultural Engineer, and H. P. Paranjape, Divisional Horticulturist, engaged the class in place of Messrs. Schutte and Cheema as they were out in district. All the lectures and demonstrations were interesting and instructive, and, I think, the officers will be benefitted by those lectures and demonstrations. The second advantage of this class was that most of the difficulties and misunderstandings between the Expert and Propaganda staff were removed and, I hope, that this will lead in the reduction of correspondence to a certain extent. The last but not the least important advantage of this meeting was, it gave all the district workers time, sufficient to exchange their views and ideas, and discuss fully the work going on in different divisions as well as the adverse conditions under which they have to work.

As Dr. Mann had to go away the village demonstration was taken by Rao Saheb M. L. Kulkarni, Deputy Director of Agriculture, S. C. D.,and the party was taken to Shivna, a village near Khadakvasla. It was an interesting demonstration and will be a useful guide to all the new men. Dr. Mann was not expected back on Saturday and hence the meeting was declared closed on Friday, the 21st of April 1922, after finishing the village demonstration work except for those who wanted to see the slow irrigation method on the Manjri Farm which was to be demonstrated on the Manjri Farm on Monday, the 23rd of April 1922.

One more item of importance, which was taken during this session, was the "At Home" and a lecture given to the members of the Propaganda staff by the members of the Deccan Agricultural Association on Tuesday the 18th of April 1922. For this meeting the Expert staff as well as their Assistants were invited and all who were in Poona attended this function. It was nicely arranged and the discussion was interesting and will lead to achieve the proposed aim. Our thanks are due to the Secretaries, Mr. Thakar and Professor J. B. Knight, of the Association which may please be communicated to them.

I have the honour to be,
Sir,
Your most obedient servant,
(Signed) K. M. PAWAR,
Inspector of Agricultural Schools.

List of agricultural bulletins published by the Department of Agriculture (1908 to 1920-21) and kept for sale at the Government Book Depot, Bombay, Poona.

Subject.

No.	Year.		Price. Rs. a. p.
30	1908	Field, Garden and Orchard crops of the Bombay Presidency, by G. A. Gammie, Economic Botanist, Bombay	0 12 0
32	1908	Locusts in India, by H. M. Lefroy, Imperial Entomologist, Pusa	0 8 0
33	1909	Cultivation of Broach Cotton in Dharwar, by M. L. Kulkarni, Divisional Inspector of Agriculture, S. D.	0 4 0
,,	,,	,, (Kanarese)	0 4 0
34	1909	Night-soil—A Valuable Manure, by G. K. Kelkar, Assistant Professor of Agriculture, Agricultural College, Poona	0 4 0
35	1909	Kalar in Sind, by G. S. Henderson, Deputy Director of Agriculture, Sind	0 4 0
36	1910	First Experiments in the Treatment of Grape-Vine Mildew in the Bombay Presidency, by W. Burns, Economic Botanist	0 14 0
37	1910	An Examination of the Seed-Supply of the Broach District, by G. D. Mehta	0 4 0
39	1910	The Salt Land of the Nira Valley, by Harold H. Mann, Principal, Agricultural College, Poona, and V. A. Tamhane, Laboratory Assistant, Agricultural College, Poona	0 5 0
40	1911	The Cultivation of Guavas near Poona, Dharwar and Limbgaon	0 12 0
41	1911	Groundnuts in the Bombay Deccan	0 4 0
42	1911	Note on Long-stapled Cotton in Sind	0 3 0
43	1911	An Examination of the Seed-Supply of the Broach District, Part II	0 5 0
44	1911	Preliminary Study of the Red Rot of Sugarcane in the Bombay Presidency	0 8 0
45	1911	Second Year's Experiments in the Treatment of Grape-Vine Mildew in the Bombay Presidency	0 14 0
46	1911	Seed Selection Series I, Broach Cotton	0 8 0
47	1911	San Hemp	0 4 0
48	1911	Poona Furnace	0 7 0
,,	1911	(Marathi)	0 6 0
49	1911	An Examination of the Seed-Supply of the Ahmednagar District, Part I	0 5 0
50	1912	An Examination of the Seed-Supply of the Ahmednagar District, Part II	0 3 0
51	1912	Third Year's Experiments in the Treatment of Grape-Vine Mildew	0 3 0
52	1912	Muscovado Sugar Machinery and its scope for Gul Manufacture in India	0 8 0
53	1912	A Method of improving the Quality of Cotton Seed	0 7 0
54	1912	A Note on Steam Ploughing	0 10 0
55	1913	An Examination of the Seed-Supply of the Poona District	0 3 0
56	1913	Present State of the Dairying Industry in Bombay	0 3 0
57	1913	Improvement of the Indigenous Plough of Western India	0 12 0
58	1913	Prickly-Pear Experiments	0 14 0
59	1914	Common Salt and its use as Manure in the Konkan Division	0 3 0
60	1914	Note on Indian Sugar Industry and Modern Methods of Sugar Manufacture	0 12 0
61	1914	Sugarcane, its Cultivation and *Gul* Manufacture	0 5 0
62	1914	The Value of Castration of Deccan Bullocks	0 3 0
63	1914	Substitutes for Rab	0 3 0
64	1914	Alkali or Kalar Experiments and Completion Report of Daulatpur Reclamation Station in Sind	0 14 0
65	1914	A list of diseases of Economic Plants occurring in the Bombay Presidency	0 4 0
66	1914	Indigenous Implements of the Bombay Presidency	2 2 0
67	1914	An Examination of the Seed-Supply of the Sholapur District	0 3 0
68	1914	A Note on Well Boring	0 5 0
69	1915	The Rice Stem Borer in the Konkan	0 3 6
70	1915	Improvement of Cotton in the Bombay Presidency (except Sind)	0 3 6
71	1915	The Grape Growing in the Nasik District	0 9 0
72	1915	Experiments with the Automatic Water-Finder in the Trap Region of Western India	0 4 0
73	1915	Hand List of Plants, Seeds and Bulbs available for distribution in the Ganeshkhind Botanical Gardens, Kirkee	0 2 0
74	1915	Well Water from the Trap Area of Western India	0 6 0
75	1915	Note on Cattle of the Bombay Presidency	0 3 0
76	1915	Artificial Manures—Experiments on their value for crops in Western India	0 4 0
77	1916	Fodder crops of Western India	0 11 3
78	1916	Some wild fodder plants of the Bombay Presidency	0 13 0
79	1916	The Cultivation of Guavas in Gujarat	0 5 6
80	1916	List of Seeds available on the Agricultural College Farm, Poona	0 5 3
81	1916	Note on Fencing Construction	0 6 9
82	1916	Cultivation of drilled paddy in South Bombay Presidency	0 9 0
83	1917	The Spice Gardens of Sirsi in Kanara	0 10 6
84	1917	Seed Selection Series—Kumpta Cotton	0 1 0
85	1917	Note on Cattle in the Bombay Presidency	0 11 0
86	1917	Establishment and Management of the Dairy Farm	0 7 0
87	1918	The Utilisation of Inferior Grass Herbage, Experiments at the Tegur Cattle Farm	0 9 0
88	1918	First Report on Fruit culture as practised round about Tharushah (Sind) in Nawabshah District	0 2 0
89	1918	Artificial Manures : Experiments on their value for crops in Western India	0 3 3
90	1918	Work on the Manjri Farm for the years 1915-18	0 7 3
91	1919	The Cultivation of Berseem in Sind, Experiments at Sukkur	0 1 0
92	1919	Classification and Description of the Jowars of the Bombay Karnatak	0 10 3
93	1919	Palm *Gul* Manufacture in the Bombay Presidency (Principally Date Palm)	1 3 9
94	1919	Sugarcane Borer and its Control	0 4 3
95	1919	The Cultivation of Oranges and Allied Fruits in the Bombay Presidency	0 2 6
96	1920	Investigations into the manure of the Salt Lands of Sind	0 12 0
97	1920	Prickly-Pear as a Cattle Food	1 4 0
98	1920	Fruit Culture as Practised near Shikarpur, Sind	0 1 6
99	1920	The Rice Cultivation in the Larkana District, Sind	0 8 0
100	1920	Fodder Crops of Western India	2 1 0
101	1920	Fruit Culture in Palitana and Jamnagar	0 8 6
102	1920	Investigation of Potato Cultivation in Western India	1 15 0

No.	Year.	*Subject.*	Price. Rs. a. p.
103	1920	The Book of the Mango	3 5 0
104	1920	The Ganeshkhind Botanical Garden, Kirkee (Its Genesis and Development) ..	0 15 9
105	1920	The Groundnut Bug and its Control	0 2 0
106	1920	Dharwar American Cotton ; Its History, Cultivation and Improvement	0 7 0
107	1921	Gonag—a weed in Drilled Paddy	0 5 0
108	1921	Summary of the Work done on Jalgaon Farm	0 5 6
109	1921	The Crops of the Bombay Presidency, their Geography and Statistics	2 13 0
110	1922	Year Book of the Agricultural Department in the Southern Division	0 5 0
111	1923	A Note on Well Boring (In the Press).	

BOMBAY : RINTED AT THE GOVERNMENT CENTRAL PRESS.

GOVERNMENT OF BOMBAY.

REVENUE DEPARTMENT.

Resolution No. P-51.

Bombay Castle, 28th February 1923.

Letters from the Director of Agriculture Nos. 13255 and 13364 dated 6th and 8th December 1922 respectively—Submitting a copy of the Annual Report of the Department of Agriculture, Bombay Presidency, for the year 1921-22.

RESOLUTION.—The most important of the activities of the Agricultural Department in the direction of research and investigation is the improvement of the main crops by selection and breeding. The money value of such improvements is immense; and they can be most easily adopted by the cultivators as, unlike other improvements, they do not require any special effort or expenditure on their part, beyond organization for the distribution of the improved seed. The most valuable and successful of such improvements hitherto have been in cotton. In the Gujarat area 18 lakhs of pounds of improved seed were distributed by the Agricultural Department during the year. As noticed last year the work is growing beyond the capacity of the Agricultural Department to manage single-handed and should be taken over by co-operative sale societies and seed stores. Government have noted with great satisfaction the effort of private gin-owners and notably Mr. Bomanshaw Jamasji in securing improved seed on their own account and distributing it amongst their clientele with a view to get good cotton for ginning next season. Improved cotton has thus been spread widely in Ankleshwar taluka, Hansot mahal and part of Rajpipla State. It is also a matter for congratulation that the mixture of inferior Goghari with Surat Deshi cotton south of the Narmada has been reduced to a negligible quantity. Fairly good premia have been obtained for the improved cotton of the controlled area, but the best method of ensuring the premia is to increase the quantity while maintaining the purity of the cotton. Co-operative effort on the lines of those in the Southern Division as well as the continuance and extension of the seed distribution work done by individual gin-owners are means towards this end. Government hope shortly to introduce rules under the Restriction of Cotton Transport Bill which will protect the Gujarat as well as the Kumta cotton areas against admixture of inferior cotton, and thus help to maintain the purity of the improved types.

2. The NR type in Khandesh and the Dharwar No. 1, Dharwar No. 3 and Gadag No. 1 types in the Southern Division are now fully recognised and well-spread types. The Agricultural Department is now engaged in experimenting on improvements on these, particularly with a view to find a better stapled cotton for Khandesh than the NR.

3. It is hoped that with the appointment of Mr. Thadani, a more rapid progress in the improvement of cotton in Sind will be possible. The satisfactory work on rice and wheat will continue, it is hoped, on a more extensive scale.

4. The new strain of Kolamba rice developed at Karjat is reported to have yielded 29 per cent. above the local varieties on cultivators' fields. When its superiority over the local types is fully established it will be the aim of the Department to spread its use among the cultivators by means of propaganda.

5. A good start has been made in the study of the jowar crop at the Dharwar and Surat farms. It is proposed to start an intensive study of jowar as well as of rice in various parts of the Presidency in the course of next year.

6. Among artificial manures investigation has established the value of sulphate of ammonia for sugarcane and bonemeal for rice in laterite and light soils. It is hoped that their use among the cultivators will be pushed by vigorous propaganda. The use of oilcakes and pouderette introduced by the Department is now popular.

7. Government appointed a committee to consider and report on the measures to be taken for extending the use of iron ploughs and other improved implements. Its conclusions are summarised in Government Resolution No. 3143 of 6th October 1922. The designing and improvement of implements and production of working models is to be the duty of the Agricultural Engineer, while propaganda is to be carried on by the territorial staff of the Department aided by popular organizations. The need for propaganda is apparent when it is considered that, out of a potential demand of 4,00,000 iron ploughs in the Presidency, only 20,000 at the most are working now.

8. The Committee appointed to consider the important question of improving the breeds of cattle and the allied subjects of milk and fodder supply has not yet reported. By a recent order the Willingdon Cattle Farm in Sind and the whole work of cattle breeding in that province have been transferred from the Civil Veterinary Department to the Agricultural Department as in the Presidency proper. Under the advice of the Imperial Dairy Expert the extension and improvement of the Willingdon Cattle Farm has been undertaken. This Farm will be the means of preserving and improving the red Sindhi or Karachi breed which is probably the finest milking breed in India. A nucleus of the Thar-Parkar breed of cattle is also to be established at the Willingdon Farm.

9. In the Presidency proper Government have taken in hand the Kankrej and Amrit mahal breeds at their farms at Chharodi and Bankapore respectively. The other important breeds, *viz.*, the Gir, Khellar, Dangi and Krishna Valley, will be taken over as funds permit. Government however cannot accomplish much in this direction without the co-operation of the people. It is necessary for the latter to take to cattle breeding if substantial progress is to be made. There are hopeful signs of this in the south of the Presidency, particularly in the Dharwar district, but the movement can hardly be said to have begun. Government would also cordially welcome co-operation on the part of Pinjrapoles and Gorakshak bodies in the matter of scientific breeding under the direction of experts of the Agricultural Department. The Deputy Director has already succeeded in persuading a few local bodies to put their breeding on scientific lines under his advice. Government have no desire to interfere with or control the management of these bodies, but they wish to make available the scientific and expert advice obtainable in the Department of Animal Breeding.

10. For the last two years Government have made the most earnest efforts to bring about the closest possible co-ordination between the two allied departments of Agriculture and Co-operation, and by that means to ensure that improvements and discoveries of proved value made by the Agricultural Department are brought to the notice of the people and adopted by them. Six divisional boards consisting of officials and non-officials representing both the departments have been formed with a view to control and direct the propaganda activities of the two departments. It was seen by Government that if agricultural propaganda were to reach the masses of the people it should be intensive and should take as a unit a smaller area than the district. Under the scheme of the taluka development associations sanctioned by Government in Government Resolution No. 3378 of 5th June 1922 the taluka is taken as the unit. It is surveyed agriculturally by officers lent by the Department, and the programme suggested by them and approved by the associations is carried through with the help of a paid Secretary who is a trained fieldman lent by the Department. Government bear half the annual cost up to a maximum of Rs. 1,000. The associations work under the supervision of the divisional boards who control the propaganda grants. Several very promising associations have already been started under this scheme and many others are projected. It is estimated, to take one instance, that an enormous loss is suffered by the cultivators every year by the smut disease of jowar. The Agricultural Department, years ago, discovered a

simple and effective remedy in the steeping of the seed in copper sulphate; and yet owing to defective propaganda the remedy is not known to and used by more than two per cent. of the agriculturists who grow jowar. Government trust that a rapid development of the new propaganda scheme, under which improvements are demonstrated to the cultivators under actual field conditions on their own lands, will bring the Department into closer touch with the people and remedy this state of affairs. As the field staff of the Agricultural Department is all too inadequate to reach all the villages and the Revenue Department alone has an organization large enough for the purpose, the help and co-operation of the latter Department in the propaganda work of the former will be invaluable. With this object a circular has recently been issued to the Commissioners directing them to get Mamlatdars in selected talukas to help in popularizing the use of copper sulphate as a preventive of jowar smut.

11. The results of the Agricultural College have been very satisfactory. Its popularity has been so great that it has been found necessary to restrict the number of admissions. It is proposed to acquire more land around the College which will enable even more efficient practical training to be given. It is also being considered whether an apprentice system cannot be started in some of the Government farms in order to give confidence to the Graduates in cultivation on field scale so as to fit them for their occupation, whether they cultivate their own fields or take service with other landlords.

12. The progress of the agricultural schools at Jambul in the Thana district and in Sind has been unsatisfactory, and the latter has been closed. On the other hand a new school has recently been opened at Dhulia. The whole question of vernacular agricultural education requires serious consideration. The progress hitherto made with these schools is not such as to justify a firm belief that we are proceeding on the right lines. An experiment on different lines, providing for an alternative upper primary school course with an agricultural bias for boys intending to follow agriculture as an occupation, is to be introduced in selected schools. For Sind, Government have under consideration the introduction of vocational training in agriculture on the Punjab model in a few selected first grade primary schools.

13. A very important service the Agricultural Department renders the public is the provision of water facilities for their lands. One of the greatest agricultural needs of the country is a large increase in the number of wells. The following figures show that the increase is not proceeding at anything like the rate that is necessary for the development of agriculture:—

	Number of wells.
1896-97	2,07,057
1902-03	2,41,944
1906-07	2,53,035
1912-13	2,61,191

The Agricultural Department with its water finder, boring machines, pumps, etc., help the public in securing water. It is the intention of Government to go in for boring operations on a much larger scale while making them more self-supporting than hitherto. It is hoped to enlist the active co-operation of District Local Boards in this work. With a view to encourage the sinking of wells in the dry Deccan areas as a measure of insurance against famine, Government have under consideration a scheme for shallow exploratory borings, the greater part of the cost of which will, in the event of failure, be borne by Government.

14. Government have recently received several applications for financial help and expert advice regarding schemes of collective irrigation, which are too small for the Public Works Department and yet are on too large a scale for the ordinary staff of the Agricultural Department to tackle. Government recognize that such schemes, if technically and financially sound and carried out on co-operative lines, would be extremely useful, and they therefore intend to appoint, as funds permit, a whole time Land Development Officer with engineering experience to investigate such schemes and advise applicants on their technical aspects and cost.

Digitized with financial assistance from the Government of Maharashtra on 22 July, 2017

15. The acknowledgments of Government are due to the Director and his staff for their useful work during the year.

By order of the Government of Bombay
(Transferred Departments),

A. R. DALAL,
Deputy Secretary to Government.

G. R. No. P-51, R. D., dated the 28th February 1923.

To

The Commissioner in Sind and the Commissioners of Divisions,
All Collectors, including the Deputy Commissioner, Upper Sind Frontier,
The Director of Agriculture,
The Superintendent, Civil Veterinary Department, Bombay Presidency,
The Superintendent, Civil Veterinary Department, Sind and Rajputana,
The Principal, Bombay Veterinary College,
The Private Secretary to His Excellency the Governor,
The Director of Public Health, Bombay,
*The Municipal Commissioner for the City of Bombay,
*The Agricultural Adviser to the Government of India,
*The Secretary to the Society for the Prevention of Cruelty to Animals,
*The Government of India,
*The High Commissioner for India.

*By letter.

No. of 1923.

Copy forwarded for information and guidance to